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# Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

No. 205

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11 October 1983

# WORLDWIDE REPORT

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No. 205

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# CABINET GETS DEPARTMENTAL REVIEW OF URANIUM POLICY

Sydney THE AUSTRALIAN in English 12 Aug 83 p 3

[Article by Errol Simper]

[Text]

THE long-awaited federal inter-departmental review of Australia's uranium policy has been completed and will go to Cabinet after the Budget.

It is understood that the ministers involved — principally the Minister for Resources and Energy, Senator Walsh — are preparing Cabinet submissions on the report.

Other ministers with a close interest include the Minister for Aboriginal Affairs, Mr Holding, and the Minister for Home Affairs and the Environment, Mr Cohen.

Caucus defeated a left-wing motion on July 12 calling for the phasing out of uranium mining and the withdrawal of negotiating licences to Queensland Mines (Nabarlek) and Energy Resources of Australia (Ranger).

Other prospects whose futures hinge on the review include the huge Roxby Downs development, Jabiluka, Yeelirrie, Koongarra, Ben Lomond, Honeymoon and Beverley.

Two companies particularly interested in the outcome of the Government's deliberations are Pancontinental Mining —

owner of the Northern Territory strike, Jabiluka — and Denison, the Canadian-controlled firm which has just concluded an agreement with traditional Aboriginal holders of the Koongarra lease, also in the Northern Territory.

It became known in mid-April that the Federal Government had revoked uranium miners' licenses to seek overseas buyers of Australian yellowcake (uranium oxide).

The Koongarra was not initially exploited because of political difficulties after the Whitlam election victory in 1972 and because parts of the seam were inside the proposed Kakadu National Park. The original owner, Noranda, later sold the lease to Denison.

Some of Koongarra's traditional Aboriginal owners tried to prevent the Aboriginal Northern Land Council negotiating with Denison on the Aborigines' behalf.

The problem was solved after a court battle but Mr Holding then tried unsuccessfully to persuade the Aborigines not to sign an agreement with Denison until Government policy was formulated.

CSO: 5100/7544

DISARMAMENT ENVOY BUTLER URGES NUCLEAR BAN IN SPACE

Brisbane THE COURIER-MAIL in English 8 Aug 83 p 10

[Text]

**SYDNEY.— The top priority in Australian disarmament policy would be to ban nuclear weapons from outer space, the disarmament ambassador, Mr Richard Butler, said yesterday.**

Mr Butler, appointed by the Federal Government on July 7, arrived from his former posting, as Australia's deputy permanent representative to the Organisation for Economic Co-operation and Development in Paris, for briefings in Canberra. He will be based in Geneva.

"Our central concern is about things nuclear," he said. "Australia will be urging a general winding down of the arms race.

"We will be making every possible effort to make sure the arms race doesn't extend to outer space.

"We do not want an arms race in outer space and we will do everything we can to stop it.

"A good group of Western countries think the same way."

He said the world spent \$700 billion a year on conventional arms and a great share of that went to Third World countries.

"Now, I ask you, what does the Third World need — more weapons or more food?" he said.

Mr Butler said Australia would urge nations to look at diverting some of those funds to meet other needs of people.

The most popular weapon on

the international market today was the Russian AK-47 rifle, which cost \$800.

"In some of the Third World countries, you can run a pharmacy for a year on that," Mr Butler said.

He said his job would be to give expression to the feelings of as many people as possible on the disarmament issue.

After talks with the Foreign Minister, Mr Hayden, in Canberra early this week, Mr Butler will spend three weeks travelling the country talking to non-government groups about disarmament.

He said it probably was unusual for an ambassador to be talking to the public but Mr Hayden wanted to know what ordinary people — not just officials — felt about it.

Mr Butler said his first task in Geneva would be to attend a meeting to revise the treaty banning nuclear arms from the seabed.

Official organisations were doing a great deal of work on arms control and he would be kept very busy in his new job, he said.



CHURCH SYNOD IN WA REJECTS CALL FOR NUCLEAR-FREE ZONE

Perth THE WEST AUSTRALIAN in English 8 Aug 83 p 11

[Text]

YOUNG church-goers have rejected a call for WA to be declared a nuclear free zone.

But two-thirds of delegates at Perth's first Anglican youth synod were worried about the nuclear-arms build-up.

The synod was attended by more than 200 young people from church organisations, parishes and schools.

The Minister for Youth and Community Services, Mr Wilson, who is an Anglican priest, in the opening address urged delegates to make decisions on social issues and accept their responsibility in fashioning society.

The synod had been called to give young people the opportunity to discuss social and church issues.

The synod rejected church moves to have

women ordained as priests.

It also declined to express disapproval at moves to legalise euthanasia and at the free availability of abortion.

However, the youth synod agreed to ask the medical profession to consider the legal and moral aspects of its work and to inform the community.

A church spokesman said yesterday that the diocesan synod was expected to invite the youth synod to report to it when it meets in October. Proposals from the youth synod would then be put before the diocesan synod.

The Anglican Archbishop of Perth, Dr Peter Carnley, who was president of the youth synod, yesterday urged delegates to work with other branches of the church to achieve their aims.

CSO: 5100/7544

# ISSUE OF URANIUM MINING IN NATIONAL PARK UNRESOLVED

Sydney THE SYDNEY MORNING HERALD in English 6 Aug 83 p 6

[Article by Craig Skehan]

[Text]

CANBERRA. — A draft Cabinet submission canvassing a proposal to allow uranium exploration in the area promised as stage two of Kakadu National Park in the Northern Territory has angered conservationists and sections of the Government.

The draft submission is also understood to present five wider options on the sensitive issue of uranium mining, ranging from allowing new mines to the repudiation of all existing export contracts.

Some party sources say there is strongest support for the fourth option, which would allow the existing Naborlek and Ranger mines to seek new contracts and Roxby Downs in South Australia to proceed, but no new mines.

There is also concerted pressure to retain the existing policy of phasing out the uranium industry by not allowing new contracts.

The Kakadu proposal resurrects a Fraser Government initiative to declare more than 6,000 square kilometres a conservation zone.

The office of the Home Affairs and Environment Minister, Mr Cohen, confirmed last night that this proposal, if accepted, would allow uranium exploration.

The Australian Conservation Foundation said this could take up to five years and only those areas not required for mining would then be declared national park.

Last year, the then Opposition environment spokesman, Mr Stewart West, said a Labor Govern-

ment would declare stage two of the park in the scenic Alligator Rivers region "with no new exclusions for mining."

There are already excisions for the Ranger Mine and the proposed Jabiluka Mine.

Mr Cohen's private secretary, Mr Peter Conway, said yesterday a whole range of options was still under consideration, including the conservation zone and declaration of the area.

But other Government sources have indicated that Mr Cohen looks favourably on the conservation zone option.

The Minister for Aboriginal Affairs, Mr Holding, who is on the interdepartmental committee, is believed to strongly oppose the suggestion.

The Minister for Territories and Local Government, Mr Uren, has directly opposed it.

Joseph Glascott, Herald Environment Writer, reports: Five major conservation bodies claim the Federal Government is planning to renege on its promise to declare the second stage of Kakadu National Park.

The existing Kakadu Park is the biggest national park in Australia and, like South-West Tasmania and the Great Barrier Reef, has been declared a World Heritage area.

The planned extension has presented the Hawke Government with a conservation issue which could be equal to the Fraser Government's Franklin Dam dilemma.

## AUSTRALIA

### BRIEFS

JAPANESE URANIUM REQUEST--TOKYO--Japan yesterday asked Australia to continue to supply it with uranium after the expiry of existing bilateral supply contracts. The request was made by Japanese international trade and industry ministers, Mr Sosuke Uno, in his meeting with visiting Australian Deputy Prime Minister and Trade Minister, Mr Lionel Bowen. Japanese officials said during the 30-minute meeting the two ministers exchanged views on bilateral trade issues, centering on Japanese imports of Australian uranium and exports of steel products into Australia. Mr Uno expressed concern over moves in Australia to restrict imports of Japanese steel products. In reply, Mr. Bowen said the Australian Government was currently studying problems related to uranium supplies and steel import quotas expiring next year. It also hoped to export industrial products to Japan in addition to such items as iron ore and coal, he said. [Sydney THE WEEKEND AUSTRALIAN in English 6-7 Aug 83 p 18]

PROTEST TO FRENCH--CANBERRA--The Government has protested to France over the latest French nuclear test at Mururoa Atoll, last Friday. The Department of Foreign Affairs said yesterday that Australia has expressed strong objections to the test, which was detected by a New Zealand seismic station. The explosion was small, probably that of a trigger device. The last French test at which the Australian Government protested was on Mururoa on 28 June when the test was detected as having a yield of 50 kilotonnes. [Melbourne THE AGE in English 9 Aug 83 p 3]

CSO: 5100/7544

NUCLEAR ENERGY DEVELOPMENT PROBLEMS, ADVANTAGES DISCUSSED

Prague PLANOVANE HOSPODARSTVI in Czech No 7, 1983 pp 12-23

[Article by Engineer Miroslav Cibula, science candidate, State Planning Commission: "Development Problems of the Nuclear Power Industry"]

[Text] After the oil price shock of 1973, hopes in the development of nuclear power generation rose considerably, because nuclear power was able to supply long term the necessary quantity of energy, eliminate the shortage of natural occurrences of conventional energy sources, and compete economically with cost-ly refined fuels. Basic changes have occurred during the past 10 years in the conditions for the development of the fuel and power industry, the rise of energy consumption has slowed down, and so has the growth rate of the economy. At the same time it has been demonstrated that the obstacles to utilizing the possibilities offered by nuclear power are not technical ones, rather obstacles associated with mastering the demanding construction of generating capacities, specifically of nuclear power plants. Even though only a few countries have been able to realize without significant shortfalls and slippages their original plans for developing nuclear power generation, this sphere is developing with a speed unprecedented in the other areas of the world power industry. There is every indication that once the difficulties in the initial stage of building industrial nuclear power plants are overcome, particularly the economic structural factors and in some Western countries even the political obstacles, the growth rate of nuclear power generation will remain long term at a very high level.

In 1975, the share of nuclear power within the total consumption of primary sources of energy worldwide was merely about 1.5 percent, there were only 19 nuclear reactors in operation rated at more than 30 MW each, and their combined capacity was 71,700 MW. According to the forecasts prepared by the international organizations IIASA [International Institute for Applied Systems Analysis], MAAE [International Atomic Energy Agency, IAEA] and INFCE [International Nuclear Fuel Cycle Evaluation] and published in recent years, the installed generating capacity of the world's nuclear power plants will increase to a minimum of 531,000 MW and a maximum of 909,000 MW by 1990, and in the year 2000 it should be in a range between 1,082,000 and 2,227,000 MW. By the end of this century, nuclear power's share of the world consumption of primary sources of energy should be between 9.5 and 10.3 percent. These last two figures correspond to the low and the high scenario for the development of the world energy demand and of its supply with individual sources of energy, as forecast in

a 1981 study by the IIASA. These scenarios through the year 2000 anticipate a further relatively rapid rise in the world consumption of fossil fuels, supported by analyses of the mining, investment and production conditions, and also the possible use of nonconventional sources of energy: solar energy, fermentation gas, geothermal energy, and biomass (Tables 1 and 2).

Table 1. Forecast of World Energy Consumption and of Its Supply With Primary Energy Sources (terawatt-years/year)

	<u>1975</u>	<u>2000</u>	<u>Average annual growth rate (%)</u>
World energy consumption	8.22	13.58-16.83	3.4- 4.8
Of which:			
Petroelum	3.83	4.75- 5.89	1.4- 2.9
Natural gas	1.51	2.53- 3.11	3.5- 4.9
Coal	2.26	3.92- 4.94	3.7- 5.3
Light-water reactors	0.12	1.27- 1.70	17.0-19.3
Fast breeder reactors	-	0.02- 0.04	.
Hydroelectric power	0.5	0.83- 0.83	3.3
Solar energy	-	0.09- 0.10	.
Fermentation gas, geothermal energy, other	-	0.17- 0.22	.

Table 2. Forecast of Changes in the Structure of the World Consumption of Primary Energy Sources (percent)

	<u>1975</u>	<u>2000</u>	<u>Index 2000/1975</u>
Total consumption	100.0	100.0	
Of which:			
Petroleum	46.6	35.0-35.0	0.75
Natural gas	18.3	18.6-18.5	1.02-1.01
Coal	27.5	28.9-29.4	1.05-1.07
Light-water reactors	1.5	9.4-10.1	6.27-6.73
Fast breeder reactors	-	0.1- 0.2	.
Hydroelectric power	6.1	6.1- 4.9	1.00-0.80
Solar energy	-	0.7- 0.6	.
Fermentation gas, geothermal energy, other	-	1.2- 1.3	.

From Tables 1 and 2 it is evident that the current world forecasts of energy consumption expect relatively high average annual growth rates (3.4 to 4.8 percent) of world consumption during the last quarter of this century, and a decline of only 11.6 percentage points in petroleum's share of total consumption, which will require an absolute increase of 24 to 54 percent in the annual consumption volume in the year 2000 over 1975. During the same period the consumption of natural gas is expected to increase by between 67 and 106 percent; and the consumption of coal, by between 73 and 120 percent. Such a sharp rise in the consumption of fossil fuels is substantiated in terms of the conditions of their extraction and the technology of their use.

It appears that available world sources of fuels of organic origin, including petroleum, are much greater than what emerged from the earlier classification of reserves. The reason for this is an increase in the number of workable deposits on the continental shelves, in the polar regions, and at great depths

in the earth's crust. Another reason is the increase in the recovery of the deposits, made possible by technological progress and better equipment; moreover, high world prices of fuels have led to intensive development of technologies for the preparation, conversion and combustion of inferior and cheaper fuels such as oil shales, bitumens, coal suitable for the production of liquid synfuels, etc. This technological progress is making itself felt already now in a reduction of the necessary share of higher-grade petroleum in the consumption of energy sources and, among other things, it has been one of the reasons of the decline in petroleum prices.

According to the published forecasts and results of analytical studies, views are changing also on the question of the rapid depletion of fossil fuels as nonrenewable sources of energy. According to the latest assessments, the reserves of fossil fuels will be sufficient to cover their share of total consumption even around the year 2030, by when population growth is expected to slow down, and the world population is expected to approach an asymptotic level. These views have been the basis also of formulating the requirements for the development of nuclear power generation, which already now is performing the function of balancing the sources of energy, especially in industrially developed countries with inadequate fossil fuel deposits of their own, which applies to Czechoslovakia as well. Which means that the role intended for nuclear power generation is to solve the problem of both the inadequate quantity and the uneven distribution of the reserves of nonrenewable sources of energy. Moreover, nuclear power generation must successfully master this role without regard for the problems stemming from its initial stage of development, in which it uses essentially only one of the uranium isotopes in light-water reactors with a once-through fuel cycle, while it has to support the high cost of operation on enriched natural uranium. Only with a changeover to the technology of fast breeder reactors will the prerequisites begin to be formed for utilizing the entire range of uranium and possibly thorium isotopes, recycling nuclear fuel, and reducing the demand for additional natural uranium.

The time span for the more extensive realization of this changeover is still rather hazy, which introduces uncertainty into the long-range trends of the generating costs of nuclear power, whose ability to compete with other sources of energy despite higher investment costs is determined by the level of fuel costs. More extensive construction of fast breeder reactors cannot be expected before the year 2000. According to the latest forecasts (Tables 1 and 2), fast breeder reactors will account for only 1.6 to 2.4 percent of total output of nuclear power. In the era of fast breeder reactors, the nuclear power industry will have at its disposal a considerable primary energy potential accumulated in stocks of depleted uranium at the fuel enrichment plants, but at present it is extremely difficult to estimate the time when, and the economic and other conditions under which, this solution can be realized, especially in smaller countries.

In Czechoslovakia, by every indication, the era of building light-water reactors will extend at least into the first decade of the next century, and their use within our nuclear power industry will remain dominant substantially longer than what would correspond to their economical service life. From which it follows that the Czechoslovak power, engineering, and construction

industries should view the construction of nuclear power plants with light-water reactors as a long-term program that deserves the concentration of modernly equipped capacities in these industries, enabling them to achieve the qualitative, construction-time and cost indicators that correspond to the world level in building the nuclear power industry (Table 3).

Table 3. Forecast of the Nuclear Power Industry's Contribution to the Supply of the Energy Demand in the Year 2000 (percent)

	<u>World</u>	<u>Europe</u>	<u>CSSR</u>
Nuclear power industry's share			
In supplying demand for primary energy sources	9.5	.	15.0
In electric power generation	45.0	43.0	52.0

Sources: IIASA, WPC [World Power Conference], and educated estimates for CSSR.

Changeover to nuclear power generation is a natural consequence of the progress in science and technology. The necessary rate of implementing this changeover can be derived from the economic conditions of supplying other sources of energy, and from the results of computations optimizing the demand for energy, based on rationalization programs and linked to computations of the economic efficiency of alternatives for the fuel and power industry's development. The results of subjecting to optimization analyses the alternatives for the Czechoslovak fuel and power industry's development have demonstrated that it will be efficient and necessary to supply, by developing nuclear power generation, at least around 70 percent of the warranted additional demand for primary sources of energy to the year 2000. This share of the nuclear power industry may be regarded as minimal from the viewpoint of solving the consequences of our domestic fuel reserves' considerable depletion; and of the impossibility of stepping up further the rate of their extraction, due to the high ratio of annual output to total workable reserves; and also in view of the long-range costs of importing fuels and power.

Past development of the Czechoslovak fuel and power industry gradually increased to about 40 percent the share of import in supplying the demand for primary sources of energy. After the sharp rise of world fuel prices, it would be intolerable to further increase the share of import, even if the further rise of import prices ceases. In this situation it is economically unacceptable especially to develop further electric power generation based on imported fuel. It is more efficient to convert the electric power industry to using much cheaper nuclear fuel, at a rate that makes it possible not only to supply the increase in the demand for electric power, but also to gradually reduce the generation of electric power in power plants fired with fossil fuels, and to use for district heating the freed capacities in conventional power plants. Through the cogeneration of electricity and heat in the reconstructed coal-fired condensation power plants it is necessary to significantly improve their energy efficiency and their contribution toward restructuring the balance of capacity and energy consumption, in alternatives that satisfy the long-range economic conditions and criteria of economic efficiency.

In spite of their higher technological and investment intensity, the favorable economic results of the current types of nuclear power plants can be attributed

to their lower fuel costs than in the case of power plants fired with coal, natural gas or fuel oil. According to orientational national economic computations, the specific fuel costs of our nuclear power plants should be about 60 percent lower than the fuel costs of power plants burning domestic coal. Here it turns out that ever-more thorough and more detailed analysis of the chain of costs comes out in favor of nuclear power plants, even though long-range computations are extremely difficult due to the familiar problems with objectivizing the input cost items. The difference between the fuel costs of nuclear power plants and conventional condensation power plants should contain a sufficient reserve also for the worsening economics of nuclear power generation resulting from higher investment costs due to the realization of more and more demanding safety systems, the changeover to building nuclear power plants on more demanding sites, etc. If the investment and other costs are included not only of the power plants but of the fuel industry as well, it turns out that the specific generating costs of our present nuclear power plants are much lower than the generating costs of power plants fueled with domestic coal. This difference in costs approximates the results reported in other countries, although in Czechoslovakia the specific investment costs of conventional power plants are obviously higher than elsewhere, due to burning predominantly brown coal of lower calorific value, which improves the ratios in favor of nuclear power plants (see Table 4).

Table 4. Comparison of the Differences Between the Specific Investment, Fuel and Generating Costs of Nuclear and of Coal-Fired Power Plants in Czechoslovakia<sup>1</sup> (in percent of the costs of nuclear power plants)

	Power plants	
	<u>Nuclear</u>	<u>Coal-fired</u>
1. Components of investment cost		
Power plant construction	100.0	75.0
Investment in transmission lines	20.0	20.0
Investment in electric power industry jointly	120.0 <sup>2</sup>	95.0 <sup>3</sup>
Investment in fuel industry	25.0 <sup>2</sup>	65.0 <sup>3</sup>
2. Fuel costs (direct)	100.0	160.0
3. <u>Generating costs</u>	100.0	126.0

Footnotes:

1. Reflecting the situation that existed at the end of 1982.
2. According to Soviet sources (UISJP [expansion unknown], Vol V, No 12, 1981)
3. With due consideration for the service life of strip mines.

The efficiency of nuclear power generation can be documented on a foreign comparison of the material intensity of building and operating a conventional and a nuclear technological chain for generating electric power (Table 5). In the case of a nuclear technological chain with a light-water reactor (Table 5, item D) the material intensity during 30 years of operation is merely 3.7 percent of the material intensity of a coal-based technological chain (Table 5, item A), while the weight of the unprocessed fuel (energy-containing materials for operation) is 29 times lower in the nuclear technological chain. If more advanced mining technology is used, and if coal is transported and burned in the form of a slurry to lessen the environmental consequences of generating electricity from coal (Table 5, item B), the ratio in favor of nuclear power generation increases further. The differences in material intensity between



the coal-based and the nuclear technological chain with a fast breeder reactor (Table 5, item E) are several times more favorable than in the preceding case, despite the fact that this alternative already assumes the mining of uranium of very low grade, containing 0.007 percent  $U_3O_8$ .

Table 5. Material Intensity of Building and Operating Technological Chains for Electric Power Generation (1000 tons/1000 MW)

(9) Palivové základny a typ zařízení	(2) na výstavbu		(1) Materiály		(8) Celkem
	kovy (4)	ostatní (5)	pro provoz <sup>1</sup> (3) neener- getické (6)	ener- getické (7)	
A. Povrchově těžené uhlí — soudobá technologie <sup>2</sup>	44	142	4 000	79 000	83 186
B. Povrchově těžené uhlí — pokročilá technologie <sup>3</sup>	67	130	23 230	84 000	107 430
C. Hlubinně těžené uhlí — pokročilá technologie	65	140	23 566	84 000	107 770
D. Jaderné palivo — lehkovodní reaktor <sup>4</sup>	49,3	192,7	132	2 700	3 074
E. Jaderné palivo — rychlý množivý reaktor <sup>5</sup>	33	276,3	.	800	1 103

Source: "Energy in a Finite World," IIASA, 1981.

Key:

- |                                 |   |
|---------------------------------|---|
| 1. Materials                    | A. Strip-mined coal, contemporary technology <sup>2</sup> |
| 2. For construction             | B. Strip-mined coal, advanced technology <sup>3</sup>     |
| 3. For operation                | C. Coal mined underground, advanced technology            |
| 4. Metals                       | D. Nuclear fuel, light-water reactor <sup>4</sup>         |
| 5. Other                        | E. Nuclear fuel, fast breeder reactor <sup>5</sup>        |
| 6. Nonenergy                    |   |
| 7. Energy                       |   |
| 8. Jointly                      |   |
| 9. Fuel base, type of equipment |   |

Footnotes:

- Cumulatively over 30 years of operation, at an average annual output of 6.1 TWh.
- Strip mining with a favorable overburden ratio of 2:1, thickness of seam 9.2 meters, coal transported by rail to a distance of 900 km.
- Strip mining as in case A, but coal transported by pipeline to a distance of 900 km, combustion of slurry, and desulfurization of waste gases.
- Uranium ore containing 0.2 percent  $U_3O_8$ , 60 percent strip-mined, 40 percent mined underground, fuel elements with 3.2 percent U-235, thermal efficiency 33 percent.
- Low-grade uranium ore containing 0.007 percent  $U_3O_8$ , nuclear fuel depleted  $UF_6$  and natural uranium, thermal efficiency 40 percent.

Nuclear power generation with a light-water reactor, and its fuel cycle require very little land and few miners to mine the unprocessed fuel, but only if the fuel is produced from ores with a higher uranium content, the mining of which is the dominant at present. Should it become necessary to produce the fuel from very low-grade ore, however, the land and the mining manpower capacity

requirements of nuclear power generation with light-water reactors would increase considerably (Table 6). This shows what would happen if the recycling of spent nuclear fuel and the changeover to fast breeder reactors were postponed. Long-term use of light-water reactors operating in a once-through fuel cycle would lead to the gradual depletion of the deposits of higher-grade uranium ores. The fuel for the light-water reactors would be made from ores of gradually lower grades, which would worsen the overall economic results of the reactors.

Table 6. Requirements for the Operation of a 1000 MW Power Plant Generating 6.1 TWh/year, Including the Requirements of the Fuel Industry

	Total land in 30 years (km <sup>2</sup> )	Miners (men/year)	Total materials in 30 years (10 <sup>6</sup> tons)
1. Power plant burning strip-mined coal	10-20	500	321
2. Nuclear power plant with light-water reactor (uranium ore containing 0.2 percent U <sub>3</sub> O <sub>8</sub> )	3	50	45
3. Nuclear power plant with light-water reactor (uranium ore containing 0.007 percent U <sub>3</sub> O <sub>8</sub> )	3	300	360

Source: "Energy in a Finite World," IIASA, 1981.

In agreement with the prevailing world trend, development of the Czechoslovak nuclear power industry through the year 2000 calls predominantly for the construction of Soviet light-water thermal reactors of the VVER [water-cooled and water-moderated] type.

In the second half of the 1990's, parallel construction is very likely of VVER thermal reactors, reactors of low power rating for heat supply, and the first fast breeder reactors. Favorable results in mastering the technology of high-temperature nuclear reactors for cogeneration could advance the time span of their construction in Czechoslovakia not only for the needs of the power industry, but for metallurgy, the chemical industry, and other industries as well. An important conceptual objective for the immediate future is to gradually use the built nuclear power plants to supply their surrounding conurbations with hot water, and to utilize their existing sources of low-temperature and waste heat for the needs of agriculture and the food industry.

Since 1979 and 1980, two nuclear generating units with VVER 440 reactors have been in operation at the V-1 nuclear power plant in Jaslovske Bohunice. Construction of six more units with VVER 440 reactors is in an advanced stage. These include two units of the V-2 nuclear power plant in Jaslovske Bohunice, and four units of the nuclear power plant in Dukovany. These six generating units are to be placed in operation successively between 1983 and 1986. Preparations were begun in 1981 for the construction of a nuclear power plant in Mochovce that will have four generating units with VVER 440 reactors, and also for the construction of the Temelin nuclear power plant where the four generating units will be equipped with more powerful reactors of the VVER 1000 series. Work is proceeding intensively on surveying and selecting the sites for the construction of additional nuclear power plants. Here an important criterion

Table 7. Prognostic Assessment of Nuclear Power's Contributions to Development of the Czechoslovak Fuel and Power Industry

	1980	1990	2000	Index 2000/ 1980
1. Nuclear capacities' share (percent)				
Of domestic power consumption	1.5	9.2	15.0	10.0
Of power output	6.2	32.9	52.0	8.38
Of heat from public cogeneration plants	0.06	1.6	23.8	.
Of increase in domestic consumption of primary energy sources during preceding 10-year period	.	48.0	72.0	.
2. Increase of additional output of electricity from nuclear power plants over additional gross power consumption during preceding 10-year period (percent)	.	60.0	29.0	.
3. Quantity of fossil fuel replaced by nuclear fuel (10 <sup>6</sup> TPY standard fuel)	1.7	10.4	22.6	13.3
Of which: In power generation	1.7	10.3	20.8	12.2
In cogeneration	.	0.1	1.8	.
4. Other indicators influenced by development of nuclear power generation:				
Share of import in consumption of primary energy sources* (percent)	41.6	37.0	35.0	84.1
Fossil-fueled power plants' share of electricity output (percent)	73.5	43.2	26.0	35.3

\*Not including import of nuclear fuel.

is the long-range plan to use these nuclear power plants also for heating nearby cities, industrial plants and farms. By 1990, the combined total installed capacity of Czechoslovak nuclear power plants should reach about 5000 MW; and by the year 2000, between 10,000 and 12,000 MW, in accordance with the needs to supply the demand part of the fuel and power balance.

The attained level of construction in progress, and the objectives of the program for the construction of nuclear power plants in Czechoslovakia allow a prognostic assessment of nuclear power's contributions toward the Czechoslovak fuel and power industry's development through the year 2000. The decisive conclusions from such an assessment can be expressed in the indicators summarized in Table 7. In conjunction with the worsening long-range situation in procuring conventional sources of energy (coal, petroleum and natural gas), and with the slower growth of domestic energy consumption due to rationalization measures of a technological or structural nature, and also as a result of the expected slower growth rates of the entire Czechoslovak economy, the role of nuclear power generation has increased significantly already in this decade.

Nuclear power generation is to supply up to 48 percent of the additional domestic consumption of primary sources of energy in the period 1981-1990, and over 70 percent in the period 1991-2000. The additional output of electricity from nuclear power plants will greatly exceed the anticipated rise in energy consumption and will be used to gradually reduce the output of electricity from fossil-fueled power plants. As a result, the fossil-fueled power plants' share

of electricity output should drop from 73.5 percent in 1980 to 26 percent in the year 2000, which will be the most pronounced structural change in the area of energy conversion. Development of nuclear power generation will make it possible to stabilize the imports of fuels and power, and to gradually reduce their relative weight in the "energy sources" part of the fuel and power balance from 41.6 percent in 1980 to about 35 percent by the year 2000.

These figures indicate that in its long-range fuel and power balance Czechoslovakia is assigning a very important and unique role to nuclear power generation. Possible deviations in the realization of nuclear power generation's developmental plans could not be replaced on a larger scale with other energy sources and would be projected into a further slowdown of the rise in domestic consumption of energy. In the long-term outlook, to the best of our present knowledge, the only other developing sources of energy besides nuclear power will be imported natural gas, but the feasible range of its realizable contribution to the fuel and power industry will be significantly smaller. This has been taken into consideration in the prognostic assessment in Table 7. For economic considerations, imported natural gas cannot be used as fuel to generate electricity.

In the future, nuclear power plants will be practically the only means of generating electricity for the increase in the base load in Czechoslovakia; and, together with the peak-load hydroelectric power plants, they will be the vehicles of the electrification trends within the structure of final energy consumption in Czechoslovakia. Realization of the demanding developmental objectives in the construction of nuclear power plants is becoming one of the most important tasks of the national economic plans, because its results will directly effect, both short term and long term, the growth rate of the entire national economy. On the other hand, in conjunction with the high capital intensity of nuclear power generation, its further development will directly depend on the possibilities to allocate for it the necessary investment capital, and the capacities for the realization of the investments. A substantiated solution to this problem can be chosen only on the basis of the possible developmental alternatives' economic optimization at the macroeconomic level.

Nuclear power generation's contributions to supplying the national economy with energy can be judged on the basis of the operating results of the V-1 nuclear power plant in Jaslovské Bohunice, and of the final evaluation of its construction. From its startup in 1978 through the end of 1982, this power plant produced 17.2 billion kWh, the fuel equivalent of approximately 19 million tons of domestic brown coal for power plant use. In view of the fact that the high ratio of the annual output of this coal to its total reserves does not permit any further increase of its consumption, it becomes warranted to employ imported fuels as a basis of comparison in evaluating the benefits from using nuclear fuel. It then turns out that operation of the two generating units with VVER 440 reactors at the V-1 nuclear power plant substitutes fuel import equivalent to 2.0 billion cubic meters of natural gas or 1.6 million tons of fuel oil a year. On the basis of the average current prices in 1982, this import would cost about 2.2 billion korunas, and it would have required a substantial increase of pipeline capacity, respectively of refining capacity.

Since nuclear fuel contains highly concentrated energy and, therefore, the required quantity of such fuel is relatively small, its transportation by rail

does not create capacity problems, and nuclear power plants can be built in areas where there is a shortage of electric power, without regard for the connection of the sites to the main transportation routes. This saves power transmission costs and also reduces power losses in the distribution system. The power plants fueled with brown coal had to be built directly in the coal basins, and the power generated there had to be transmitted to bulk load centers, usually several hundred kilometers distant. Specifically for these reasons, for example, in recent decades we built four 200-kV and four 400-kV transmission lines from the North Bohemia and West Bohemia coal basins inland. Selection of suitable sites for nuclear power plants eliminates the need to build additional long transmission lines, and the distribution system will be enlarged only to the extent necessary to supply the output of the nuclear power plants to nearby industrial plants, or to the nearest junction of the power grid. There are significant benefits also for the living and working environment.

Unlike fossil-fueled power plants, nuclear power plants do not pollute the living environment with their exhausts (or otherwise). It has been proven that the actual radioactivity values of the gases and aerosols emitted through the ventilation stack of the V-1 nuclear power plant in Jaslovske Bohunice are lower by several orders of magnitude than what the norms allow. Measurements, by impartial organs, have unambiguously confirmed that operation of the nuclear power plant has not increased the radioactivity of the air and soil above the level of natural background radiation. The high quality and reliability of the installed operating systems likewise have been demonstrated.

Even if the necessary supply base for the Czechoslovak brown coal now used were available, it certainly could not be used to build such large generating capacity as the nuclear power plants under construction, without changing over to a new and better combustion technology in order to abate environmental pollution. This would result in substantially higher investment costs. As evident from the plans now on the drawing board, the costs of retrofitting the coal-fired power plants now in operation with desulfurizing equipment are close to the original costs of these plants. Even though this comparison is not entirely tenable because of the differences in time and the price increases, it is obvious that when evaluating the higher capital intensity of nuclear power generation, in the cost-comparison computations it is necessary to take into consideration also the nuclear power plants' contributions toward improving the living environment.

Since nuclear power plants must be built to meet the strict criteria of nuclear safety, the advantages stemming from their high technical quality and operational reliability are likewise not negligible. As a result of this higher qualitative level, the annual hours of operation of the nuclear power plants' installed generating capacity will be constantly higher by about 15 percent than in the case of power plants using low-grade brown coal, which is the cause of more frequent shutdowns and stoppages of these plants, especially of their boilers. Evaluation of the induced investments under our conditions likewise points in favor of nuclear power generation, although correct determination of the warranted scope and especially of the nomenclature of such investments in the computations comparing nuclear and conventional power generation is questionable.

A drawback of nuclear power plants over fossil-fueled ones is that relatively they are highly capital intensive, and this drawback is offset by lower fuel costs only in the course of operation. Their higher capital intensity, however, appears as a prime factor. Unless it is mastered, development of nuclear power generation cannot be stepped up. The situation is the more complicated because the urgent need to rapidly develop more capital-intensive nuclear power generation has arisen in an atmosphere of sharply rising fossil-fuel prices and procurement costs, in which it is equally urgent to solve also the capital-intensive conservation, innovation and intensification tasks in every sphere of energy production and consumption. This necessitates an increase of the share of investment costs for the entire fuel and power complex. In view of the large volume of investments required, it is especially important to channel and use the available investment resources the most effectively, in accordance with the criteria of economic efficiency corresponding to the requirement of maximizing the economy's return on invested capital. Such optimization is not simple and cannot be undertaken separately for each individual case. It is appropriate, therefore, to follow the example of other socialist countries and determine, on the basis of systems analyses and studies, the values of the limit costs of the individual types of fuel and energy, obviously differentiated by regions and with due consideration for the load diagrams as well. As already pointed out on the example of nuclear power generation, each specific characteristic of an energy source may significantly influence the social economic efficiency of its use. This applies, for example, in relation to the differences in transportation costs between sources of energy, to the environmental impact of their consumption, etc. Elaboration of the necessary set of methods and procedures for the optimization computations should be assigned to economics research, and also to the branch research institutes of the producers and users of energy sources. Without such tools it is impossible to make qualified decisions.

The use of nuclear energy is economical only in large stationary installations for generating electricity or supplying heat as well. The high concentration and potential of nuclear generating capacities make it possible to achieve high productivity of social labor in the construction and operation of such installations.

For example: The annual output of a single nuclear generating unit with a VVER 440 reactor is about 2.8 TWh, which is more than the electricity generated by all 22 hydroelectric power plants in the Vltava and Vah cascades of power plants, or 30 percent more than what Czechoslovakia's share will be of the electricity generated by the system of hydroelectric power plants along the Czechoslovak-Hungarian section of the Danube. The Temelin nuclear power plant with its 4000 MW (4 x 1000 MW) of installed generating capacity will be the equivalent of five 800-MW coal-fired power plants, or of twenty 200-MW coal-fired generating units, of the kind that were built in our country in the 1960's and 1970's. At the same time, throughout the entire period of building coal-fired generating units in Czechoslovakia, only 19 were built in the Ledvice, Tusimice I, Pocerady I and II, Chvaletice and Detmarovice coal-fired power plants. There is no doubt that the construction of these power plants required far more demanding supplementary and induced investments in the related branches and tertiary sphere, as compared with what the prepared concentrated construction of the Temelin nuclear power plant will require, where it

will be possible to employ the most advanced construction and installation methods on the power plant itself, at a productivity much higher than in the case of building coal-fired power plants.

Even though present nuclear technology has attained a very high level of operational safety and reliability, demonstrably several times greater than in the case of other extensively used power-generating and industrial technologies, in a number of Western countries the development of nuclear power generation is encountering criticism, including the spreading of unsubstantiated fears of accidents in nuclear power plants. Such views have been the main reason for scaling down the long-range world forecasts of the development of nuclear power. But there also appear to be many other motives for this. The most important ones are competing interests, political power struggle, and the slower growth of energy demand and the shortage of investment capital caused by the slowdown of the economy's growth. Even so the constant polemic over the safety level of nuclear power plants has been reflected in the more and more demanding and perfect technical measures to ensure their safety and reliability. This has made the construction of nuclear power plants substantially more expensive and has raised their specific investment cost. In spite of this disadvantage, contemporary nuclear power generation is able to compete economically with conventional power generation.

Under the specific conditions in Czechoslovakia, where there is no other alternative solution to or substitute for nuclear power generation, assessment of the economic efficiency of changing over to nuclear power generation is warranted only in relation to the rate of its development with the framework of the alternatives for the development of the entire national economy.

The scale of building basic generating capacities in nuclear power plants is predetermined by the urgent need to solve the long-range shortage of domestic power-plant fuel, to reduce the share of imported fossil fuels, and to ensure that the bulk of the long-range increase in energy demand in Czechoslovakia is ensured by using nuclear fuel. Which means that also the capital intensity of building nuclear power plants must be considered from the viewpoint of other possible alternatives for solving all these circles of problems (Table 8).

Table 8. Long-Range Forecast of the Share of Nuclear Power in the Output of Electricity in Czechoslovakia

	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2030*</u>
Czechoslovak population (millions)	15.0	16.0	17.0	20.0
Per capita power consumption (MWh)	4.85	5.6	6.8	10.5
Total power consumption (TWh/year)	73.0	90.0	115.0	210.0
Nuclear power plants' share of power consumption (percent)	6.2	30.5	52.0	71.0
Power output of nuclear plants (TWh)	4.5	25-30	55-65	150.0
Installed capacity of nuclear plants (GW)	0.88	5.28	10-12	25.0

\*Indicative estimate.

The higher capital intensity of nuclear power generation must be compared with the savings that arise in capital construction in the coal industry, and with the savings in those manufacturing industries whose output would be intended

for export, to pay for the import of sources of energy. According to approximate computations, the necessary developmental investments in these areas would be several times greater than the differences between direct investments in nuclear and in conventional power plants. For example, if we were to replace the output of the nuclear power plants with imported fossil fuels and the construction of conventional steam power plants, in manufacturing this would require production capacities with an annual output of about 10 billion korunas for export, in a structure corresponding to the needs of our foreign partners, with the demanding solution of the necessary raw-material base. In addition, we would have to build the necessary capacities for fuel transportation or--if we were to import electricity--ensure our participation in financing the construction of foreign power plants. Economically these alternatives are entirely unacceptable.

At the macroeconomic level the import intensity of building Czechoslovak nuclear power plants is entirely offset by cooperation agreements that call for exporting the output of our nuclear engineering industry to the other CEMA countries. Only about a third of the Czechoslovak output of nuclear technology is earmarked for domestic capital construction. In principle the imports from capitalist countries for the construction of nuclear power plants do not exceed the volume of import necessary for the construction of conventional power plants. The decisive item within the import intensity is nuclear fuel, but about a third of its procurement cost is the unprocessed uranium that Czechoslovakia exports. According to the conducted analyses, the direct costs of importing nuclear fuel cells are about one-third of the direct cost of importing the equivalent amount of refined fuels.

The Czechoslovak nuclear power industry is an integral part of the CEMA countries' nuclear power industry. Agreements on developing socialist cooperation with the Soviet Union and other CEMA countries ensure the long-term supply of complete fuel cells from the Soviet Union; and the division of the production programs for nuclear technology ensures the decisive subassemblies for installation in nuclear power plants, and the mastering and rationalization of their operation. This also provides favorable prerequisites for the constant rise of the Czechoslovak nuclear power industry's technological level, and for the further improvement of its economic results and of its ability to compete with the other branches of the fuel and power industry.

Investments in nuclear power plants and in the related areas of nuclear technology bring with them a new quality and complexity, and also demands for their programmed planning and management, in cooperation with all the participating ministries. The mastering of this capital construction and the constant perfection of its management, in accordance with the tasks set by the 16th CPCZ Congress, are the initial prerequisite for achieving the contributions expected of the unique role that nuclear power generation will play in the long-range development of the national economy.

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CSO: 5100/3040



INTER-AMERICAN AFFAIRS

ARGENTINE ATOMIC ENERGY CHIEF INTERVIEWED IN CHILE

PY220143 Madrid EFE in Spanish 1059 GMT 21 Sep 83

[Text] Santiago, 21 Sep (EFE) -- Admiral Carlos Castro Madero, chairman of Argentina's National Atomic Energy Commission [CNEA], has stated that Argentina has an open door policy for the transfer of nuclear information and technology with Latin American countries.

During an exclusive interview granted to EFE last night, the CNEA chairman stated that the proof that this is not just talk and that it is backed by facts "is the new agreement signed yesterday with Chile, a country with which we have been maintaining relations in this field since 1975, as well as other agreements in force with Brazil, Uruguay and Peru."

Moreover, according to Castro Madero, a letter of intent has already been signed with Colombia, and Algeria is also interested in Argentine nuclear technology.

Adm Castro Madero pointed out that all these agreements clearly prove "that all our guidelines are directed toward peaceful purposes because, if we had belligerent goals in mind, we would try to avoid any links being detected and would not offer our technology and experience to our brother countries openly."

He also termed as absurd the report by the U.S. newspaper THE NEW YORK TIMES that Argentina is preparing an atomic bomb, and that for this purpose it has taken 1 ton of uranium out of international control.

"We produce 180 tons of uranium which are not under international control, and the report that we are hiding a ton from control is a groundless argument," the admiral stated.

"I think this report has a British origin, aimed at creating distrust in Latin American nations, in order to affect, somehow, the solidarity they all expressed for Argentina during the Malvinas conflict," Castro Madero added

The Argentine installations are not under control of the IAEA, and the reason, according to Adm Castro Madero, is that "this control is the clear consequence of the policy of the great powers, based on their restrictions on the transfer of technology."

"The control is carried out as a consequence of the technology that comes from abroad, creating in this manner a network of controls which makes impossible any development toward military purposes. But if technology is not transferred and we are forced to do our own research, with the tremendous expenditures it implies, we cannot be forced to submit to a control," Castro Madero stated.

According to the admiral, "we are ready to be controlled, but in exchange for technology transfer, because we feel that the nuclear energy trade must be intensified, instead of trying to prevent the proliferation of technology."

Castro Madero explained that the people feel solidarity with the plan which is being carried out, and that they hope that the government that will come out of the forthcoming elections will continue with the program, "despite the limitations imposed by the economic recession."

Argentina is making very large investments in nuclear plants such as "Atucha 1" and "Embalse" which are operating, and "Atucha 2" which is under construction.

As for overall installed electricity capacity, nuclear power provides 10 percent, while it generates 15 percent of the country's energy.

Castro Madero explained that the future plan is to develop hydroelectricity and nuclear energy, to substitute for the consumption of fossil fuel, and reach the end of the century with the use of 70 percent of hydroelectricity, 15 percent of nuclear energy, and 15 percent of conventional thermal energy.

Castro Madero concluded by saying that after British atomic submarines operated in the South Atlantic, without being condemned by any of the nations, it became very clear that nuclear-driven engines are compatible with peaceful ends; and Argentina, therefore, has not discarded it, "although it is a project of major importance, and first of all, it must be determined whether it is viable or not."

CSO: 5100/2095

INTER-AMERICAN AFFAIRS

BRAZILIAN NUCLEAR ENERGY OFFICIAL ON TIES WITH ARGENTINA

PY021440 Buenos Aires Domestic Service in Spanish 1030 GMT 2 Sep 83

[Unnamed radio announcer's interview with Dr Rez Nazare Alves, president of the Brazilian National Nuclear Energy Commission, at the end of a 4-day visit to Argentina; place and date not given--recorded; answers in Portuguese indistinct, translation into Spanish rendered by radio announcer]

[Text] [Question] What do you think of your visit to Argentina?

[Answer] I am leaving for Brazil today, and I am very grateful for the invitation by the Argentine Government, the hospitality of the Argentine people, the frank and friendly way in which we discussed various matters and for all the facilities I was allowed to visit. In sum, I am pleased because we have the possibility of increasing the ties established by our governments in May 1970.

[Question] What was the main result of your visit?

[Answer] We concluded that it is possible for our governments to cooperate satisfactorily in the fields of isotope production and nuclear security.

[Question] Doctor, we mainly want to know what the possibilities are of each country? You have a chance to visit Itaipu and various nuclear plants. Could you please give us your impressions?

[Answer] I got the impression from the nuclear plants that I visited that Argentina is seeking to improve its technology in order to attain nuclear independence and produce its own electricity, which is indispensable for its future. I am very satisfied with the successful nuclear program Argentina is implementing. Argentina must be congratulated in this field, and Argentina's future generations will profit from the fruitful job of Vice Admiral Castro Madero, the head of the Argentine National Atomic Energy Commission.

CSO: 5100/2088

## NEW AEC HEAD COMMENTS ON NUCLEAR POWER POSSIBILITIES

Bombay THE TIMES OF INDIA in English 27 Aug 83 p 9

[Text] PUNE, August 26. Dr. Raja Ramanna, chairman-designate of the Atomic Energy Commission, said today that India would be able to produce 10,000 MW of nuclear power by the turn of the century.

Speaking to newsmen at Walchandnagar, about 145 km. frtm here, he said the production of nuclear power at present was 1,000 MW. The present nuclear plants at various places had the capacity to produce 230 MW. each, which had now been raised because it was necessary to study the economics behind the power generation.

When asked to explain the present position, vis-a-vis the supply of heavy water, Dr. Ramanna said arrangements had been made to improve the situation. However, he refused to answer any further questions on this issue saying that he had yet to assume the charge of the chairmanship of the A.E.C.

On the question of the use of thorium in place of enriched uranium, he said India had plenty of thorium. We could produce Uranium-233 from it and next year we would be able to set up a small reactor with this. U-233. He said we would have enough of this material to produce 10,000 MW. of nuclear energy.

Dr. Ramanna said the Tarapur plant was working very well, though it tripped sometimes. On the question of radiation, he said some people were indulging in exaggeration.

He said India was facing a shortage of nuclear scientists as a number of physicists, after graduating from the I.I.T., were "defecting to the West." However, there were now a number of talented scientists who were prepared to work for the nation and with their help we could definitely flourish, he added.

Dr. Ramanna agreed with the managing director of the Walchandnagar Industries Ltd., that credit for the success in the field of nuclear energy and the manufacture of the equipment should be given to the skilled engineers and workers of the private and the joint sectors. On the question of self-sufficiency in the field of nuclear energy, he said the country was self-reliant to the extent of 90 per cent in this field.

CSO: 5100/7156

## NEW AEC CHAIRMAN MEETS PRESS IN BOMBAY

Calcutta THE STATESMAN in English 7 Sep 83 p 4

[Text] BOMBAY, Sept. 6.--Dr Raja Ramanna, chairman of the Atomic Energy Commission, has asserted that there was no new source of energy for India other than nuclear power in future and India would have to go in for nuclear energy in a big way.

Talking to reporters on Sunday at the Bhabha Atomic Research Centre here, Dr Ramanna explained that the Atomic Energy Department's programmes were oriented towards the setting up of nuclear power stations.

The Fast Breeder Test Reactor at Kalpakkam will be ready for operation by the next year. The nuclear programme was aimed at going in for breeder cycle and it was well within the capabilities of the country.

Besides the FBTR, another reactor using U-233 produced from Thorium irradiated in Trombay reactors, was also expected to go into operation next year, he said.

The R-5 reactor at Trombay was fast nearing completion and was expected to go critical next year, he added.

The MAPP unit-1 at Kalpakkam was working at 80 MW continuously since August 28 and this would go up as soon as safety clearance was given across the mid-mark of 100 MW. This was according to schedule and he was proud of the achievement.

Regarding the department's proposal to set up nuclear power stations in the country so as to produce 100,000 MW by the end of the century, Dr Ramanna said India had the full knowhow and capacity to achieve this target. About the location of these stations, Dr Ramanna said that economic considerations would not influence the location policy. The stations would be located where the grid could take the power. Moreover, every grid needed to be fed by mixed power sources for its stability. This idea would have repercussions on the location policy.

The FBTR was just little more than a year away from completion and the components were at the site. Dr Ramanna expected that the necessary carbide fuel would also be ready by the end of next year.

The work on FBTR began in 1973. Most components were manufactured in India. He complimented the Indian industry for the way they had risen to meet the challenge.

Dr Ramanna said that for the proposed research centre at Indore, a site had already been selected. Scientists would concentrate on research in fusion, lasers and accelerators. He expected that the fusion reactors and accelerators for breeding had great possibilities in the next centuries and said that India would not lag behind.

He was critical of some countries which had decided not to supply components unless some unequal commitments were signed. This had been one of the reasons for some hold-up in the implementation of the department's programme. However, India had sufficient knowhow and adequate manpower to be independent of these pressures.

Dr Ramanna felt sad that a country which had taken the trouble not to produce nuclear weapons even though it had the knowhow and had applied all the necessary restraints, was still being discriminated against by way of denial of vital imports for its nuclear programme.

This was made even worse because the countries which were restricting supply to India were testing Neutron bombs and other devices in large numbers, he remarked.

The AEC chairman felt that the nuclear power projects were criticized somewhat unfairly because of the difficulties of setting up many of these projects on time. Some delays were owing to inexperience and a lot because of non-availability of components and the absence of the required number of trained personnel. However, the department was fast building up self-sufficiency in this respect.

Many of the problems of the power stations related to matters other than nuclear reactors. The problems concerned turbines and grid fluctuations and local conditions. He did not expect these problems to continue in case of future reactors.

Regarding the Tarapur atomic power project Dr Ramanna said it was logical to expect that when a reactor was bought, spares required for the maintenance of the reactor was a necessary commitment of the suppliers, irrespective of it was required for safety reasons or otherwise.

He said there was no radiation hazard at Tarapur. India had the capacity to manufacture the spares. For this, however, a certain degree of radiation exposure might be necessary in order to refabricate the parts. But he hoped that the spare parts would be forthcoming as in any other commercial project.

CSO: 5100/7159

## NUCLEAR SUBMARINE PROJECT REPORTED 'IN SHAMBLES'

Bombay THE TIMES OF INDIA in English 3 Sep 83 pp 1, 9

[Article by Praful Bidwai]

[Text] BOMBAY: Twelve years after it was sanctioned by the Centre, a project for designing a nuclear power plant for Indian Navy submarines lies in a shambles at the Bhabha Atomic Research Centre here.

BARC has not only failed to make any worthwhile progress on the power plant design; it has also proved itself incapable of learning from its past mistakes which have entailed a waste of over 1.1 million scientific man-hours, besides costing the exchequer well over Rs. 7 crores in money.

The submarine propulsion plant project was code-named "Plutonium Recycling Project (PRP) by BARC and "Diesel Propulsion System Development Establishment" by the Indian Navy.

BARC was given overall charge of the project on the specific stipulation that it would deliver to the Indian Navy detailed designs in three years at the cost of Rs. 5 crores. This was done at the express initiation of Mrs. Gandhi.

The specially created PRP cell of BARC scientists began work on the pressurised water reactor (PWR) design only in August 1976, under the overall supervision of Dr. Raja Ramanna and Dr. P. R. Dastidar.

The progress of the project since then has been a history of failures, frequent changes of basis design concepts and parameters, utter mismatching of inputs and outputs, reluctance to acknowledge mistakes, prevarication at the top and middle levels, and repeated attempts to cover up shortcomings and failures.

### Concept Discarded

Thus the basic design concept on which BARC started work in 1976 was suddenly discarded in January 1979. This was arbitrarily replaced by a new unproven and unworkable design frame. But even this was dropped seven months ago because it could not work.

The still newer, third design is said to be no better than the second one. But there has been virtually no progress on it either and it may have to be jettisoned soon as unviable. Meanwhile no explanation has been offered for the failure of the first two designs nor a reason for a total change in BARC's design approach. However, more than 30 scientific officers have managed to receive rapid promotions and salary increments, thanks to the existence of the project.

The basic parameters within which the design of the submarine nuclear power plant was to be developed are that it should deliver a thermal output of 85 to 90 MW, that it must fit into a small 30 foot diameter submarine hull; that it should accelerate or decelerate the vessel rapidly, and that it should be capable of running for a total of 7500 full-power-hours without refuelling. (This corresponds to about six years' normal operation. Incidentally, the main advantage of a nuclear-powered submarine is that it can operate for long periods without refuelling, unlike an oil-powered vessel which consumes large quantities of fuel and also needs a great deal of oxygen for which it must surface frequently).

These parameters entail a miniaturised but powerful reactor using a very highly enriched fuel (normally containing more than 95 per cent uranium-235 or plutonium) in a small core. For reasons closely connected with the operations of a submarine, the water cooling the core cannot be allowed to boil (as in a reactor of the Tarapur type). To prevent boiling, the water is pressurised to level as high as 2000 p.s.i. (pounds per sq. inch).

#### Ground Rules

To meet safety requirements as well as the efficiency standards demanded by submarine operations, certain ground rules are laid down for the power plant design. These specify, for instance, that the start-up of the reactor from a "cold" state to full power output should not take more than the short span of five and a half hours, but that in no case should there be any form of boiling of the coolant water. The ground rules stipulate a large number of technical norms and ratios as well as safety measures.

The two designs that BARC worked on for six and a half years till January last violated not one but several of these rules. So slipshod was the work done by scientists that it produced nothing but contradictory and unworkable results.

The first design, for instance, would have produced a plant that could never have fitted into an even larger submarine hull. It would have ensured that there would be bulk boiling of water even under far-from-abnormal conditions of operation. Nor could it have delivered even half of the stipulated 7500 full-power-hours of operation.

The first design, a rather quaint type based on the single-pass rod-fuel model, could be seen to be unviable and unsafe as early as in mid-1977 or early 1978. The fuel rods would crack up and fail under normal design conditions. And the cooling achieved by water passing only once through the core



would not be adequate. A large number of scientists had become disillusioned with the basic design concept and made constructive criticisms of it, but to no avail. They were overruled by their superiors who insisted that the design would work efficiently and as top scientists and designers anywhere they knew their job.

#### Design Dropped

BARC kept assuring the Union defence ministry that the design was not only workable but safe, faultless and efficient. In April 1978, for instance, it told the ministry that the work was almost complete.

Then suddenly, in nine months' time, BARC dropped the single pass fuel-rod based design. Not a word of explanation was offered for discarding it less than eight months before the deadline for delivering the final product--August 1979. Two and a half years had been wasted.

If the first design was a disaster, the second was to prove no better. This was based on a what is called an "open lattice" core, in which fuel rods clad in a complex formation through which coolant water is circulated.

According to a senior scientist associated with the project, this design has a number of major disadvantages. These include the use of boron as a poison in the moderator: the difficulty of manipulating control rods and of removing defective ones without opening up the pressure vessel in which the core is housed--which can take weeks to remove--, the presence of toxic tritium (an isotope of hydrogen) in the reactor due to boron.

The second design was so dysfunctional that it could have led to the near-melting of fuel at the centre of fuel rods in parts of the core at full power output and also to boiling of water under conditions of rapid acceleration of the submarine.

There were big holes in the design, too big for the scientists concerned not to notice. But the top administrators at BARC insisted that it would work safely and efficiently. However when the deadline for the completion of the project, August 1979, was past, the pretence could no longer be sustained.

BARC then tried a new stratagem: in March 1980 it asked the defence ministry for a whopping Rs. 150 crores in exchange for which it would deliver not the design (which it had failed to produce) but the reactor itself! Ironically, it backed its claim with a report containing some details of the discarded design.

#### New Stratagem

The project had by this time run into insurmountable problems and most of the scientists associated with it, though not the top brass, had become disillusioned with both the old and new basic design concepts. By the end of 1980 it had become clear to all concerned that the design would not work. Over four years had been wasted. Meanwhile the BARC Officers' Association had

submitted a memorandum to Mrs. Gandhi, expressing the fear that "some of our Projects...may run into serious difficulties in future unless the working environments here is drastically changed"

As work on the second design proceeded, at the insistence of the top brass, it became increasingly obvious that no solutions could be found to the basic problems: operating and manipulating the control rods, which are necessary to shut down the reactor or to build up power; vibrations; slow start-up; and the difficulty of preventing overheating of fuel and boiling of water. It also became clear that the reactor would not be able to deliver the required full-power-hours, nor, thanks to the boron poison in the moderator, could it start up within five and a half hours. That would take up to 18 hours. The system was basically unsafe and violated several ground rules.

The leadership of the project had thus been on the wrong track altogether--for the second time since 1976.

Some scientists raised several questions about the basic approaches adopted by the PRP group at BARC, but were effectively silenced by their superiors. This was the fate of all those who made constructive criticisms of the design or suggested modifications of specific sub-systems. The scientists were told their superiors were experts in the field; the job of nuclear R & D should be left to the specialists in nuclear R & D.

Thus the charade went on until January this year, when the second design was suddenly dropped. No explanation was offered either for this or for the adoption of a third design model. This is said to be based on an as-yet-untried arrangement of fuel rods in hexagonal modules, instead of rectangular ones. It is likely, say the concerned scientists, to prove as problematic as the second one.

The sudden shift to this model has involved giving up the option of working on the commonest and the most proven design of a submarine reactor, the double-pass plate type. This design has been in successful operation since the mid-fifties, when the U.S. Nautilus was launched. The Soviets also use a similar design. More than 200 submarines all over the world use this design type.

Detailed authentic documentation of this design, with some specific details and numbers scored out, has been available in a published form for years. Engineers of the U.S. firm, Westinghouse, which designed the Nautilus power plant, have published a number of reports where, short only of some details, a great deal of information and experimental data has been presented.

#### Navy Dissatisfied

The BARC library has in its possession a number of such reports. Ironically, the top brass which has run the project into problem after problem, has not taken these seriously and rejected the design concept without assigning any reasons for it.

The core group of the scientists who were associated with the first (two) designs has been transferred or removed from the PRP. The new set, who have replaced them, are however nowhere near achieving results.

The Navy is reported to be greatly dissatisfied with the progress of the project and has repeatedly asked for detailed discussions between its technical personnel and BARC scientists on the design, BARC has discouraged and stalled such discussions but continues to claim that it can complete the job. The scientists working on the project, however, feel much less assured and confident.

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## WRITER ARGUES AGAINST FAST BREEDER REACTOR

Bombay THE TIMES OF INDIA in English 31 Aug, 1 Sep 83

[Articles by Praful Bidwai]

[31 Aug 83 p 8]

[Text] The department of atomic energy has asked the government for the huge sum of Rs. 750 crores to build a large "prototype fast breeder reactor" (PFBR) with a power generating capacity of 500 MW. A "feasibility report", put together by the DAE's PFBR working group and recently submitted to the Centre, calls for an early investment of this magnitude, including a hefty Rs. 92.5 crores in foreign exchange. The project, it claims, will be on stream by 2000 A.D.

Even by the rather special standards the DAE tends to set for itself, this is a strange request. For the much smaller fast breeder test reactor (FBTR) at Kalpakkam, with a thermal output of 42.5 MW (of which a third will be electrical), is nowhere near completion. The current target date for its full commissioning--revised and postponed several times over the eleven years that have passed since construction commenced--is the end of 1984.

But the FBTR is likely to be delayed even further. By present indications, the last of the crucial pre-commissioning operations--the charging of molten sodium coolant--will be months behind schedule. This means that the next set of steps, such as achieving criticality and final commissioning, will take the FBTR project into 1985.

This will consequently delay by a much longer time, such as five to ten years, the generation of detailed performance data from the FBTR. This data is an indispensable input for the design of any larger reactor. It is simply impossible for the DAE to extrapolate from the oil designs supplied by the French for the FBTR (with an electrical output of only 12 to 15 MW) and pull off a workable design for a 500 MW reactor.

And yet the DAE has proposed precisely such a scaling up by a factor of 30 or more--all at one go. Even if possible, such an attempt would be irrational and, as will be argued later, fraught with a number of technical, economic and environmental problems which the DAE has shown no capacity whatsoever to master.

## Hazardous System

But to start with, no country in the world has attempted a high jump from 15 to 500 MW in fast breeders, since it involves dealing with an unmanageably large number of unknowns in an extremely hazardous, accident-prone and expensive system which becomes more and more unwieldy as it grows in size.

An accident in a fast reactor is far more probable and much deadlier than in a conventional water-cooled nuclear reactor. A fast reactor uses a highly fissile fuel (plutonium or highly enriched uranium mixed with natural uranium). The chain reaction is caused and sustained by fast, highly energetic neutrons which are not "moderated" or slowed down as in a conventional reactor based on "thermal neutrons"; it generates intense heat which is removed by the coolant--typically, a molten metal such as sodium. The sodium in turn transfers the heat to water to produce steam which drives a turbine to generate power. The reactor is also called a "breeder" as it produces more fissile material than it consumes.

The fast reactor is an attempt at taming the bomb. It is more difficult to design or build and considerably more difficult and risky to operate than a conventional "thermal" reactor. It is also at least twice as expensive as the latter, megawatt for megawatt.

Even countries with a higher technological capability than India's and with a much longer experience with nuclear power and with larger (600 to 1300 MW) nuclear-thermal reactors, such as the U.S., USSR, West Germany, France and Britain, have not risked leapfrogging from the 10 to 50 MW range directly to the 500 MW size fast reactor.

But the DAE has proposed such a jump even though it cannot design or operate a conventional water-cooled thermal reactor anywhere near that size and though its performance in respect of the smaller 200 to 235 MW range reactors of the CANDU (Rajasthan and Kalpakkam) type has been far from satisfactory.

Significantly, the DAE's proposal for the PFBR comes at a time when the rest of the world is pruning, or soft-pedalling on, fast reactor development, on techno-economic as well as environmental grounds. Britain, for instance, has slashed its fast reactor R & D programme. In the U.S., the 350 MW Clinch River breeder, which has hung fire for 12 years, remains mired in uncertainty. Uncharacteristically long delays dog the French and Soviet fast reactor programmes as their costs skyrocket. Fast breeders are no longer regarded as the technology of the future; they are fast taking a back seat in energy R & D programmes the world over; they are on a hopelessly slow track.

## Specious Arguments

What is the DAE's main argument for its ambitious fast breeder programme? It is three-fold; first, that India's resources of fossil fuels are limited and may not last beyond the 21st century. Secondly, the country is relatively poor in uranium but rich in thorium deposits; thorium can be used as a fuel

in a fast reactor along with plutonium reprocessed from the spent fuel of water-cooled conventional nuclear reactors. And finally, that the DAE can design, build and successfully operate such a system, containing its capital costs to only one-and-a-half times those of conventional nuclear reactors.

All these arguments are specious. The first one not only under-estimates India's coal and oil reserves and the likelihood of future discoveries, but also exaggerates the future (21st century) demand for one particular form of energy--electricity. It makes no allowance for long-term changes in the technology of energy production and consumption. It also rules out the probable contribution of other energy sources, in particular the renewable ones. Besides, it fails to establish the need, leave alone the urgency, for the chosen alternative, the fast reactor.

The thorium-cycle concept is based on equally abstract and a prioristic premises, starting as it does from the desirability, not the feasibility, of using thorium as a substitute for uranium. No one has yet demonstrated the feasibility of the large-scale use of thorium in a breeder or evaluated its technical or economic performance. The argument for it cannot be that the fast breeder is preferable because the fuel costs of thermal-nuclear reactors are likely to rise substantially; for that would totally negate the DAE's old and only, justification for the conventional nuclear reactor vis-a-vis fossil fuel power plants, viz that uranium fuel costs are much lower than those of coal or oil. It is simply illegitimate to hold both that low fuel costs make the conventional nuclear reactor cheaper than fossil fuel stations and that high fuel costs of the former justify the fast reactor.

Finally, in view of the DAE's far from glorious performance as a designer and operator of relatively simpler nuclear power plants, its claimed capacity to design or build a more complex and hazardous system such as the fast breeder is open to question. Even less sustainable is its claim that it could build the 500 MW fast reactor at one-and-a-half times the cost of a thermal reactor. Not only has the DAE not built or adequately designed any reactor of comparable size; nowhere in the world has the capital cost of the fast breeder been lower than twice that of the conventional nuclear reactor.

#### Capital Cost High

This may itself be an underestimate. As a well-documented study shows, the capital cost of the West German 300 MW prototype plant SNR-300 is five times that of a comparable conventional nuclear reactor. Besides, the DAE's track record in respect to cost overruns has been appalling. In the case of FBTR itself, the costs incurred so far exceed the original estimate by a factor of 2.3.

Given the fact that both the Tarapur and CANDU type of stations are essentially based on imported designs, the DAE's design capacity is open to doubt and as yet unproven. Even taking to account the much smaller FBTR, the DAE is yet to demonstrate that it is capable of designing, building and operating any kind of fast reactor on its own. It received detailed designs for the FBTR direction from the French. Those were based on a reactor named "Rapsodie",

which repeatedly ran into problems and had to be closed down last year. "Rapsodie" used as fuel a mixture of 30 per cent plutonium and 70 per cent enriched uranium (containing 85 per cent U-235) in the oxide form.

The FBTR will use a carbide fuel, a mixture of 70 per cent plutonium and 30 per cent natural uranium. No one, to whose data and experience the DAE has access, has used this kind of fuel for any length of time. This fuel has its own problems; it has a high reactivity and a lower melting point than the oxide fuel does. Even more significant, the reactivity of this fuel tends to rise rapidly, and in principle, uncontrollably with temperature, unlike in conventional or certain other kinds of fast reactors.

This makes for a potentially dangerous or even explosive situation in the case of routine leaks, mechanical or electrical equipment failure, power excursions or loss of coolant--accidents that are far from uncommon in fast reactors.

[1 Sep 83 p 8]

[Text] Simply put, the economic argument against the fast breeder is that while its capital costs are at least twice as high as those of the conventional nuclear reactor, its fuel costs are no lower. The best of the existing studies of costs (based on U.S. British and French data) suggest that, despite the presumed gain through plutonium breeding, the fuel costs of the fast reactor are of the same order as those of the conventional reactor. This makes the total power generating costs of the breeder twice as high or higher.

There is no rational basis for hoping that these will fall. On the contrary, there is every possibility that they will rise. As recent surveys have shown, plutonium reprocessing can add 30 per cent or more to the cost of power. These and the costs of waste handling and disposal are likely to increase, not decrease.

Strong as it is, the economic reasoning is doubly reinforced by arguments deriving from the hazards of the technology and its environmental consequences. Because of the very nature of the fission in a fast reactor (caused by fast neutrons), a number of aspects of its working, including the behaviour of the fuel and the coolant, remain only imperfectly understood. Thus, operational problems, some of them unpredictable, are routine in the fast reactor.

In fact, every single one of the world's dozen or so fast reactors has been plagued by a whole series of them. There have been literally hundreds of minor "incidents" (read accidents) in these plants year after year. At least three fast reactors have had to be permanently shut down on account of major accidents--a record that is glaringly worse than that of the conventional nuclear reactor. So serious is the fast reactor's potential for a core melt-down that many reactors have had to be designed specifically to include a "core-catcher," a contraption whose function it is to prevent the disintegrated parts of the core from going critical on their own.

## Blast Threat

A fast breeder reactor can easily turn into a bomb under certain conditions. A disruption of its core can occur in a fraction of a second. Even a minor leak of sodium can create enormous problems, since the metal reacts explosively with water or air. The interaction between fuel and coolant is also fraught with problems. An official U.S. report focusses on some of the problems with sodium in a liquid metal cooled fast breeder reactor (LMFBR):

"The sodium-heated steam generator system is one of the most critical of the non-nuclear elements of the LMFBR plant, owing to the demand on it for extremely high reliability of the sodium to steam water boundary and the necessity to make the system capable of safely accommodating any failure of this boundary and the resulting sodium water reaction that could occur--all to be accomplished with assured functional performance and tolerable equipment and operational costs.

"Despite the intensive steam generator development in the LMFBR community throughout the world since the 1950s, the assurance that the designs now being implemented will in fact be adequately reliable for commercial plants is clouded by the difficulties with leaks, tube vibration and flow instabilities that prevented sustained operation of United States Fermi plant steam generators in the 1960s, the numerous small leaks that have delayed start-up of the British PFR since last 1974, and the large leak sodium water reactor incidents that have occurred in the Russian BN-350 beginning in 1973."

Dangerous sodium leaks have occurred in most fast reactors in the world. For instance, the French reactor, Phenix was closed down for most of 1975-76 and between October 1976 and June 1977 and against last year owing to such leaks.

From leaks to power excursions to metal fatigue (which can occur when metal is subjected repeatedly and suddenly to high stresses), to a disruption of one part of the core, any number of factors can combine to produce a serious accident in fast reactors. And any accident in them has the inherent tendency to escalate rapidly. While in the normal thermal reactor, massive leaks of coolant will shut down the system, in fast reactors they can tend to increase the reactivity and put the chain reaction out of control--in seconds.

## Potential Hazard

One major source of the potential hazard posed by the fast reactor is that, unlike a thermal reactor, it contains several hundred critical masses of plutonium or uranium. (A "critical mass", brought together and left to itself, will start an uncontrolled chain reaction and become a bomb. A bomb is, in fact, just that. The critical mass for plutonium and uranium-235 is of the order of 10 kg!) If a small part of the core is disrupted or broken and compacted together, it can go critical on its own and make the reactor super-critical. This phenomenon, called "recriticality," is among the greatest hazards of the fast reactor.



All these problems and hazards are sought to be controlled through various and increasingly complex mechanisms. But two problems arise here. The more complicated the system, the more vulnerable it becomes; and also more difficult to control. Secondly, with increasing size, costs skyrocket; to control these, compromises are struck with the safety of the system. This is happening with the French 1200 MW "Superphenix" reactor series, the new designs for which seek to dispense with the entire containment (concrete shell), thus destroying the possibility of giving the public some sort of protection against core meltdowns or big leaks of radioactivity.

The problems of safety engineering get worse as the size of the reactor increases, thanks to a phenomenon connected with the coolant, called the positive void coefficient or reactivity. In simplified terms, this means that the probability of reactivity and core temperature increasing and leading to a serious accident rises greatly as the total volume of the reactor increases.

This makes designing, building, and operating, say, a 500 MW reactor far more complex and qualitatively different from constructing and running a 40 to 50 MW fast breeder. It is different from scaling up a chemical plant, or a thermal reactor.

The fast reactor also poses much greater hazards. The consequences of a serious accident in it tend to be much more devastating than those of a mishap in a conventional nuclear reactor. In fact, it gets are too awesome to contemplate. A sober, recently published, analysis of a potential mishap at Kalkar, a 300 MW W. German fast reactor, shows that under certain not-uncommon weather conditions, there could be as many as 1.25 lakh early deaths, and another 8.1 lakh cases of cancer and lung morbidity in the case of a serious accident involving the vaporisation of 10 per cent of the core.

#### Unproven System

The DAE's proposal for a 500 MW PFBR must be seen in the light of all these facts. It asks the government to make a commitment of hundreds of crores of rupees on a system that will be at least twice as expensive as the conventional nuclear reactor, power from which is already much more expensive than from coal. Should we opt for a power trajectory that is fraught with great hazards, is not proved to be safe or controllable and which can cause a great loss of human life and widespread ecological destruction in case of an accident?

The fast reactor system is not proved to be necessary or safe for power generation. Worse, it will launch India on "a spiral", an irreversible high-technology course that demands more and more investment in related and downstream plants (reprocessing and waste management) and involves increasingly elaborate techniques but greater hazards.

The arguments advanced so far by the protagonists of the fast reactor programme are too weak to counter the thrust of the arguments against. Even the (often implicit) reasoning that India must undertake such a programme in order to keep abreast with this "leading edge of technology" is no more than

a feeble plea for huge funds. For, the fast breeder does not constitute anything like a leading edge, and its potential cannot justify anything more than a modest R & D programme.

The case for the PFBR is further weakened when seen in the light of its opportunity costs. Any large expenditure on fast reactor R & D such as even a tenth of the Rs. 750 crores the DAE is asking for, inevitably means less money for other R & D programmes in more relevant and more immediately promising fields, whether they are photovoltaics, hydroelectrical, methanol synthesis, coal-based power generation or bio-mass. It is unnecessary to spell out the implications of this except by pointing out that if a even fraction of nuclear R & D resources were to be diverted to research on more promising, potentially cheaper and environmentally benign energy sources, India could quickly acquire the world leadership in the field.

Support to the dearer, more hazardous and less promising PFBR programme will, on the other hand, effectively destroy such a possibility.

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## SITING FOR NUCLEAR POWER PLANTS DISCUSSED

Damascus AL-FURSAN in Arabic No 184, Jun 83 pp 15-18

[Article by Dr Ahmad 'Umar Yusuf, minister of electricity: "Nuclear Power Stations in Syria"]

[Text] In view of current planning involving the introduction of the first nuclear power plant, having a capacity of 2 x 600 (or 3 x 440) megawatts, into the power supply system in Syria during 1991 and 1992, we present this study which is a brief presentation of the siting specifications of nuclear power plants, taking into consideration local conditions in Syria.

As we know, the siting requirements for nuclear power plants which produce electricity are basically the same construction requirements as for conventional thermal power stations, but with increased emphasis on safety and protection from radiation. There are also some basic matters which power station engineers are aware of and which must be taken into consideration when constructing any type of power plant which utilizes steam power. They are the following: (1) there should be a source of sufficient water which can be utilized for condenser cooling water; (2) it should be near the load centers; (3) one should bear in mind considerations concerning transporting and delivering the fuel (for example, the refineries should be nearby); (4) conditions for building the plant foundations should be right, and the site should be a suitable one; and (5) appropriate means of transport should be nearby for the purpose of transporting the heavy components needed for the plant.

So far, when selecting among proposed sites for the construction of thermal power plants, the Ministry of Electricity has not encountered any opposition caused by anxiety on the part of those concerned with regard to lines, air pollution, thermal pollution, or obtaining the right to build electric power lines across areas where they need to be built. The reason for this is that Syria is a country with a rather low density of population. However, it is anticipated that it will become more and more difficult to select sites for new power plants. The reason for this is that Syria's population is continually increasing and Syria is becoming more and more developed, especially in the provinces where industry is concentrated--and these provinces are, of course, centers for the conveyance of electric power loads. These are the provinces of Aleppo, Hamah, Tartus, Hims, and Damascus.

The selection of sites for new power plants, whether it involves the expansion of existing power plants in Baniyas or the installation of new power plants in new locations such as, for example, Maskanah, is a matter which is basically decided on the basis of the criterion of increasing demand for electric power in areas where it is consumed. In addition to this, the condition of the electric power transmission network is taken into account. Also, another decisive factor in selecting such sites is the availability of water for cooling.

If it were only a matter of attempting to avoid increasing air pollution in the industrial centers of the country, then nuclear power plants would be the type of power plants to be preferred.

#### General Features of Sites for Nuclear Power Plants in Syria

One could say that, as a result of the tremendous progress that has been achieved in the field of safety techniques, there is, in principle, no reason not to construct nuclear power plants either in industrial centers or near large cities. However, licensing commissions in many industrial nations do not yet share this point of view.

The availability of water for cooling is a decisive factor when it comes to determining the site for such plants in a country such as Syria. The reason for this is that the sources of water in Syria, with the exception of the area adjacent to the Euphrates River, are already burdened with the task of meeting the water requirements of Syria's industry and providing sufficient drinking water for the country's population.

A nuclear power plant having a light-water reactor with a yield of 33 percent releases to the cooling water a thermal capacity which is about 40 percent higher. [This thermal capacity] is also released by large conventional thermal power stations, which utilize steam power, which carry out cooling by means of open cooling towers, and whose yield is 46 percent.

If we assume that the average annual temperature of river water is 20 degrees centigrade and that the increase in the temperature of this water which is allowed depends on the flow of the water, then this means that the demand will be for a quantity of cooling water ranging between 5.55 and 6.94 cubic meters per second for each 100 megawatts produced by nuclear power plants which carry out cooling by means of open cooling towers.

On this basis, the requirement for normal operation of a nuclear power plant having a capacity, for example, of 600 megawatts would range between 33.20 and 41.46 cubic meters per second or between 119,880 and 149,904 cubic meters per hour.

Conventional power stations having the same capacity require only between 24.97 and 32.30 cubic meters per second or between 89,910 and 119,880 cubic meters per hour, assuming that the conditions are the same.

In Syria, only the Euphrates River--and only in the area around Maskanah--is capable of furnishing a sufficiently abundant source of water for cooling to

be carried out in nuclear power plants with a capacity of 600 megawatts which carry out cooling in open cooling towers.

When cooling is done by means of closed cooling towers--that is, by means of wet recooling [sic]--this requires relatively small additional quantities of water in order to compensate the loss of water from the cooling structure due to evaporation, leakage, and filtration. In this regard it should be mentioned that the Ministry of Electricity is currently inviting bids for the construction of a power plant utilizing steam power with a capacity of 2 x 150 megawatts in the Damascus area. The power plant will burn fuel oil, carry out cooling in closed cooling structures by means of dry air, and will rely on sources of ground water to provide for its cooling water requirements which will total about 100 cubic meters per hour. Plans are for operation of this plant to begin in 1985. However, economizing the use of cooling water in this plant will necessitate a decrease in the plant's yield (about 5 percent) in comparison with yields in similar plants which carry out cooling by means of evaporation.

Experts differ in their opinions regarding what the costs of the facilities of such plants are. They markedly prefer one of the two above-mentioned cooling systems for power plants whose capacity is between 300 and 600 megawatts, but there is no doubt in their minds concerning the fact that the yield will be less in the above-mentioned case which was discussed.

In general, one can say that nuclear power plant sites, as opposed to sites for conventional power plants, require the following additional features:

1. It is preferred that the site be sufficiently far away from densely-populated industrial areas and principal transportation routes. However, as we know, this distance requirement can be overlooked in the even of utilization of engineering control systems--which, however, greatly increase the high costs of nuclear power plant facilities. One can, then, construct commercially available nuclear power plants near densely-populated areas without this constituting a danger to the population.

In this regard, one could say that the costs of these engineering protection systems which permit the construction of nuclear power plants in electric load centers can, in many cases, be considered to be, to a certain extent, equivalent to costs which result from the lack of flexibility [which has been shown] in the construction of conventional thermal power stations.

2. With regard to cooling water requirements, it is expected that progress in nuclear reactor technology will lead to an improvement in this operation, and it is expected that this will lead to a reduction of the thermal power which is sent to the cooling water system or even make the process of cooling by means of dry air a practical possibility.

Technologically speaking, high-temperature reactors which operate in closed gas turbine structures according to the West German principle are able to produce helium gas temperatures as high as 1,000 degrees centigrade or higher. Utilization of the dry air cooling process for high temperatures is something which has its advantages.

The process of cooling by means of dry air is one which is rather expensive for all types of commercially available nuclear power plants. However, the situation could be different only for high-temperature reactors which operate in closed gas turbine structures--and they are still in the stage of development.

In view of this, utilizing the system of cooling by means of dry air in this reactor would not only enable such reactors to be temptingly economical. This system would also guarantee an operation free of pollution.

Therefore the construction of nuclear power plants could be possible in areas of the country where water is either scarce or not abundant. It is difficult to imagine the other power plants operating by means of utilizing the dry air cooling system without having to bear huge [additional] costs. However, British nuclear power plants which utilize high-temperature reactors, advanced gas reactors which utilize steam heated by means of nuclear power, and breeder reactors are preferred to others because of the possibility of cooling them by means of utilizing dry air.

3. The location of a power plant's chimney with relation to prevailing winds should be such that radioactive gas waste materials are not carried to populated areas. Such waste should be carried to unpopulated areas instead.

4. The preferred site for a nuclear power plant is a site which is on a rock foundation. This is in order that there not be leakage of liquid radioactive waste materials into adjacent areas in case of serious accidents or in case the waste disposal system stops working.

5. Nuclear power plants with a capacity of 600 megawatts may call for components which weigh as much as 300 tons. Components which are this heavy can be transported on roads overland by means of multi-axle trailers. However, the most widespread solution for this transport problem is the utilization of ships which are able to anchor in the site's docking area. In a case such as this, one is faced with the problem of procuring appropriate hoisting apparatuses.

6. If a site on the coastline is selected, then the best place would be near al-Ladhiqiyah or Tartus. But if a site is selected where abundant fresh water is available, then it should be in the Euphrates River basin. In case the latter site is chosen, changes would have to be made in the existing overland roads which lead to the site, and this is something which will involve an increase in the costs of building the facilities.

#### Underground Construction

The construction of underground or semi-underground nuclear power plants is something which is necessary only if they must be utilized during wartime or as an effective means of keeping them secure from either sabotage or hostile military actions.

Syria is one of the nations which has signed the International Atomic Energy Commission treaty concerning the non-proliferation of nuclear weapons, unlike the Israeli enemy.

The recent Israeli attack on Iraq's peaceful nuclear research facilities has increased our interest in constructing nuclear power plants underground in Syria, in spite of the additional economic burdens which this would entail.

Concerning the matter of protecting nuclear power reactors against aerial bombardment, there are measures which can be taken even if construction has been done aboveground. It is also possible to provide protection by constructing the plants below the surface of the ground in a hollow or in a bedrock depression.

These various measures involve numerous requirements for the sites which will influence the selection of the site for the first nuclear power plant to be built in Syria.

In case aboveground construction is utilized, protection for the plants against aerial bombardment will basically be carried out by means of reinforcing some of the installation structures and setting up means of protective defense above vital equipment centers. As for the matter of construction inside a rock formation which is thick enough to provide protection against the various types of conventional weapons, this is something which is subject to the laws of the mechanics of rock formations. One could consider a rock thickness of 50 meters to be a useful basic thickness for this purpose.

Underground construction of nuclear power plants requires the creation of openings in rock formations, the dimensions of which must be up to 40 meters for a power plant with a capacity of 600 megawatts. Openings in rock formations with such large dimensions have apparently not been created anywhere in the world. This is something which, without doubt, would lead to complications in the licensing procedures for such sites.

In case the rock formation cover requirements for an underground site do not exist in Syria, it may become necessary to violate tradition and lower the level of operation as far as the level of the cooling water basin is concerned or else resort to the semi-underground alternative.

Semi-underground construction--that is, construction of a nuclear power plant in a hollow and putting a concrete roof on it--means reducing the distance between the surface level of the ground and the level of the cooling water in comparison with this distance when construction is carried out inside a rock formation.

It is possible to design a roof which is thick enough and well supported enough to stand up to the largest conventional bombs. One could also generally say that underground construction provides protection against hostile military actions which is better than that provided by semi-underground construction. Furthermore, underground construction is less offensive as far as an area's general scenery is concerned. As far as the costs of the facilities are concerned, they are about the same whether the construction is underground or semi-underground.

Estimates indicate that nuclear plants which are constructed underground are about 20 percent more expensive to construct than are such plants which are

constructed aboveground. A large portion of these additional costs are due to the interest payments which must be paid during the period of construction--and the construction of underground plants lasts about 1 and 1/2 years longer than the construction of plants aboveground. In addition to this, operational and maintenance costs are somewhat higher in the case of plants which are constructed underground.

It is very important to find bedrock having the proper prerequisites as far as ground water is concerned. If an underground site involves a rock formation which is not suitable, the additional costs can be large ones. Because of this, searching for these critical sources of ground water will be a major activity as far as construction of the first nuclear power plant in Syria is concerned.

These matters were taken into consideration in the booklet containing the stipulations of the contract pertaining to Bid Invitation Number 694 concerning the provision of consultant services regarding the utilization of nuclear power plants to produce electricity for Syria. A contract will be awarded concerning the provision of these services.

#### Plan for Evaluation of the Site

With regard to the final selection of the site for the Syrian nuclear power plant which will have a capacity of 2 x 600 megawatts, and with regard to evaluating the suitability of this site, this is an activity which should proceed slowly and carefully on the basis of specialized professional work which could be generally divided up into the three following steps:

Step I. This step involves evaluating the demand for electric power and the systems for producing this power in Syria, and this includes the following: (1) the development of electric power consumption; (2) the systems of electric power production; (3) the electricity transmission network and transformer stations; (4) the costs of alternative production systems; and (5) the creation of optimum solutions for the system of electric power production.

Step II. This involves the selection of the site for the nuclear power plant, and this requires the following: (1) taking an inventory of possible sites; (2) analyzing these potential sites; and (3) evaluating and selecting the nuclear power plant site which is the most suitable one in terms of the technology to be used and in terms of costs, safety, and environmental considerations.

Step III. This involves detailed studies of the site chosen as a basis for the plant's design and for the preparation of the requests for licensing, and this includes the following: (1) geological and seismological studies; (2) environmental studies; (3) studies of the surface water hydrology; (4) meteorological studies; (5) radiation studies; (6) studies of other external influencing factors; and (7) studies dealing with supplying equipment to the site.



The deadlines for the completion of these construction services, as related to other activities dealing with setting up the first nuclear power plant in Syria, are as follows:

#### Selection of Possible Sites

Predictions of operational load capacities of the electricity network in Syria indicate that it will certainly be possible to introduce nuclear power units having a basic capacity of 600 megawatts starting in 1990.

An initial study of the country's geography and the power program planned up till the year 1995 suggests that there are two areas where the first nuclear power plant, having a capacity of 2 x 600 megawatts, could be set up, and they are the following areas:

##### I. The Maskanah Area

If we take into consideration that it is possible to raise the temperature of the rivers, for industrial cooling purposes, by only about 4 degrees centigrade in the winter and by about 2 degrees centigrade in the summer--due to environmental reasons--then it becomes evident that a nuclear power plant having a capacity of 2 x 600 megawatts requires a flow of cooling water ranging between 290,000 and 360,000 cubic meters per hour. The Euphrates River is the only river in Syria capable of providing the flow of cooling water required for the utilization of open cooling towers.

The site proposed in the Maskanah area is located behind the al-Tabaqah Dam. The plan is to set up three conventional power units, each with a capacity of 300 megawatts, in the same area before 1990. This will mean that the province of al-Raqqa, where the hydroelectric power plant with a capacity of 8 x 100 megawatts was constructed and which began [operation] in 1992 [as published], will become the most important province in Syria as far as power production is concerned. This province will be producing about half of the nation's electric power supply.

The Maskanah site also has the following additional advantages:

1. It is near the province of Aleppo which is a large consumer of power, it is near the 400 kV transmission network which is under construction, and it is also near the currently existing 220 kV transmission network.
2. Underground construction will probably be possible in this area which characteristically has many elevations and sandstone and limestone rock formations.
3. A nearby road which links the al-Tabaqah Dam with the nation's ports will facilitate the process of bringing in the heavy equipment necessary for the plant and this will cut down on other transport costs which will emerge as a consequence of the project.
4. The site is located far away from the country's densely-populated areas.

## II. The Coastal Area

This area starts at the border with Lebanon in the south and runs north through Tartus and Baniyas till it ends in the area above al-Ladhiqiyah. The population in this area is continually increasing and the area's sources of fresh water are sufficient at the present time. However, demand for fresh water is increasing here as time goes by.

It is assumed, of course, that the cooling water to be used in the open cooling tower in this area will be water which comes from the sea. By 1987 the installation in Baniyas [of a power plant] of the conventional steam-power type with a total capacity of 1,240 megawatts should be completed.

If we take into consideration that the largest oil refinery in Syria is located in Baniyas, then it appears that either the northern area of this region (near al-Ladhiqiyah) or the region's southern area (near Tartus) would be the most logical place to construct this first nuclear power plant which will have a capacity of 2 x 600 megawatts.

The area near al-Ladhiqiyah is an area with numerous depressions and an area which has a rocky coastline, and thus it is especially suitable for underground construction.

However, the Tartus area is also a preferred area because it is near the electric load centers in Hamah, Hims, and Damascus. It is also near the Lebanese electric power network which is connected to the Syrian electric power network.

Nevertheless, construction of a nuclear power plant on the coastline has the following disadvantages: Although the coastline area would provide an unlimited supply of water for the cooling condenser, it is more costly to construct and maintain cooling condensers which utilize seawater than it is to construct and maintain cooling condensers which use river water. [missing text] additional atmospheric [missing text], and it may be demonstrated that underground construction is something which cannot be avoided.

9468

CSO: 5100/4510

ADVANCED NMR SPECTROMETER ACQUIRED BY NCRL

Pretoria SCIENTIAE in English Jul-Sep 83 pp 19-20

[Text]

Nuclear magnetic resonance (nmr) spectroscopy is one of the most widespread modern methods for studying the chemistry of complex molecules, and the recent acquisition by the National Chemical Research Laboratory (NCRL) of a Bruker WM500 nmr spectrometer has ushered in a new era in the application of this technique in South Africa. It is the most advanced such instrument currently available and very few have until now been installed elsewhere in the world.

As part of the national nmr service facility provided by the NCRL to universities and other institutions, the new instrument will provide local scientists with unique opportunities to undertake research in the forefront of their fields.

The phenomenon of nmr was discovered in 1946 and, although its potential as a structural tool was quickly appreciated, it was several years before the first commercial instruments made an impact on chemical research. The first nmr spectrometer in South Africa was installed at the NCRL in 1962; this instrument operated with an electromagnet generating a field strength of 1,4 Tesla and could only be used for recording proton nmr spectra at a radio frequency of 60

MHz. This restricted the resolution and sensitivity of the technique.

Subsequent instrumental developments resulted in progressive expansion of the NCRL facilities, and it was then that the laboratory was given the responsibility of providing a service to universities and other institutions.

The Laboratory has received international recognition for contributions to the development and application of nmr spectroscopy, particularly in the fields of organic and organometallic chemistry. The new instrument will ensure that the NCRL can continue to play a prominent role in this area.

The WM500 spectrometer functions through the latest superconducting magnet system, at a field strength of 11,747 Tesla with a corresponding proton resonance frequency of 500,13 MHz. The magnet comprises a coil manufactured from a niobium-tin alloy, which is cooled to the temperature of liquid helium and then energized.

The only subsequent attention required is the re-filling of the cooling systems with liquid helium and nitrogen in order to maintain the superconductivity.

The most dramatic advantages of high magnetic field, such as is available with the new instrument, are

increased sensitivity and greater dispersion of nmr signals. This makes it easier for spectra to be interpreted and for meaningful results to be obtained using very small amounts of material. This, in turn, has led to advanced studies of more complex molecules.

The Laboratory has already made significant progress in these areas and there is a growing demand for the more sophisticated applications. New research problems, such as the conformation of proteins, which could not have been solved without the facility, can now be undertaken.

CSO: 5100/56

## SUNI BECOMES PART OF CSIR'S NUCLEAR ACCELERATOR CENTER

Pretoria SCIENTIAE in English Jul-Sep 83 pp 34-35

[Text]

The Southern Universities Nuclear Institute (SUNI) recently became part of the CSIR's National Accelerator Centre (NAC) at Faure in the Cape. It is now known as the Van de Graaff Group of the NAC.

SUNI was established to enable scientists and students of the southern universities to undertake fundamental research in the fields of nuclear physics and chemistry. Experimental facilities were provided to give local students greater opportunities to undertake postgraduate research in South Africa.

The idea of having such a research institute in the southern Cape was first mooted in 1956. When the establishment of a Southern Nuclear Institute was incorporated into a national nuclear research programme for South Africa, a campaign for public support for the capital requirements of such an institute was initiated.

The institute was formally created when its charter was signed in March 1961. In May 1962, the first members of the permanent staff (Prof I J van Heerden and Dr W R McMurray) took up their appointments.

SUNI had 20 professional, technical and administrative personnel. An additional two had been seconded by NUCOR to the isotope unit based at SUNI and another had been sponsored by the Cape Provincial Administration for medically orientated research and services.

Since 1964 when the accelerator first became operative, nearly 100 000 hours of accelerator time have been used for a total of 45 MSc degrees and 35 doctorates, over 300 publications in international scientific literature, and about 100 contributed papers at international conferences.

Investigations into the physical sciences at SUNI have added to the total store of knowledge and understanding of nuclear characteristics and nuclear interactions. This has been widely used in research and application work covering divergent disciplines such as: analytical chemistry, solid state studies of surfaces, oceanography, coastal engineering, archaeology and medical sciences.

The Government recently decided that this facility should become an integral part of the CSIR's National Accelerator Centre, which is being

built at Faure on a site adjoining that of the former SUNI. The SUNI Board of Governors and its staff saw eventual integration of the institute into the national accelerator facility as an inevitable and logical development.

The integration of SUNI into the National Accelerator Centre does not mean the cessation of its functions. It is a new beginning within a larger context.

CSO: 5100/56

## SOUTH AFRICA

### BRIEFS

CSIR CYCLOTRON'S ANNIVERSARY--The Pretoria cyclotron of the CSIR has been in operation for 25 years. The total income from radio isotopes manufactured in this accelerator recently passed the R2-million mark. Nuclear physicists and representatives of all South African organizations which work with radio isotopes, met in Pretoria recently to celebrate the two events. A short symposium on the history and development of the Pretoria cyclotron and the manufacture and use of isotopes, was followed by a festive lunch and a visit to the accelerator facility itself. Radio isotopes have been manufactured in the cyclotron since 1965. Sales to local and foreign institutions have steadily increased--today the CSIR exports certain long-lived radio isotopes for industrial use and earns about R170 000 for South Africa in this way. Almost the same amount is earned through local sales. CSIR isotopes were specially ordered by the United States National Aeronautics and Space Administration (NASA) for use on board the Viking spacecraft for soil analyses on Mars. Locally, radio isotopes from the CSIR cyclotron are used for medical, biological and industrial applications. The Pretoria cyclotron facility is at present undergoing modifications with the financial support of the Transvaal Provincial Administration so that radio biological work may be done there and neutron therapy services be provided. The Pretoria cyclotron is a division of the CSIR's National Accelerator Centre with its headquarters at Faure in the Western Cape. Photo Caption: The Pretoria cyclotron of the CSIR recently celebrated 25 years in the production of radioisotopes. Here past heads of the cyclotron are seen with the present head Dr F Haasbroek at the function held to mark the jubilee. They are, from left: Dr S J du Toit, Dr G Heymann, Professor I J van Heerden, Dr S J Mills, Dr F Haasbroek and Professor W L Rautenbach. [Text] [Pretoria SCIENTIAE in English Jul-Sep 83 p 26]

KOEBERG EVACUATION DRILL PLANNED--CAPE TOWN--People living within 16 kilometres of Koeberg nuclear power station should make provision for alternative accommodation in case the area ever needs to be evacuated, Escom advised yesterday. Pamphlets outlining evacuation procedures are to be distributed before the station opens. The Cape Town bus service will be involved in evacuations and mass care centres will be established to accommodate people. This was disclosed at a news conference in Cape Town yesterday when details of an emergency exercise next Tuesday were released. The media, divisional councils, civil defence and other organisations will be involved in the exercise, but the public is excluded. An alarm system and public loudspeaker will warn the public within five kilometres of the station of any emergency, and the provincial traffic force will be involved. In serious emergencies the SABC will broadcast warnings. [Text] [Johannesburg THE CITIZEN in English 15 Sep 83 p 2]

FRG. BIDDING FOR LONG-TERM ZAMBIAN URANIUM SUPPLY CONTRACT

Lusaka DAILY MAIL in English 16 Sep 83 p 1

[Article by George Makulu]

[Text]

From GEORGE MAKULU in  
Saarbrücken, W. Germany

THE FEDERAL REPUBLIC of Germany is bidding for a long term contract for the supply of Zambian uranium once mining gets underway. Saarberg Interplan president, Mr Jurgen Ertle told President Kaunda here that Germany needed a long term dependable supply of uranium to keep its nuclear power stations going.

He told the President that Germany did not have enough uranium to meet its national requirement and wondered whether the shortfall could not be supplied by Zambia.

Mr Ertle made the request when he conducted a presentation of his company's activities throughout the world.

The Saarbrücken-based company has been carrying out uranium exploration work in Slavonga and the Copperbelt for the last three years.

The director, who said that

prospecting was now "in full swing" assured Dr Kaunda that this firm would do everything possible to ensure that a viable uranium industry was set up in Zambia.

"Germany needs a long-term secure supply of uranium, because we have to guarantee the continuous operation of our nuclear power stations. For this reason, we would like to ask you and your government to grant us long term supply contracts," he told the President.

In reply, Dr Kaunda told Mr Ertle that he would pass on his request to the appropriate authorities in Zambia.

He assured the company that the Party and its government would continue to co-operate with it in its important task.



## EUROPEAN AFFAIRS

### SWEDISH NUCLEAR FIRM COMPETING WITH USSR FOR ROLE IN FINLAND

Stockholm DAGENS NYHETER in Swedish 1 Sep 83 p 10

[Article by Kaa Eneberg: "Swedish Nuclear Power in Finland; Asea Atom in the Starting Blocks"]

[Text] Helsinki, 31 Aug--Svenska Asea Atom's prospects of becoming the contractor for new nuclear power plants for Finland are good, DAGENS NYHETER has learned. The Finnish electric power industry is in the starting blocks, but with increasing irritation over the fact that the government does not give the go-ahead signal. The state must announce its basic position soon, they are saying.

In recent years, nuclear power has become a hot potato in Finland, where an antinuclear power movement has grown up and is making itself heard. Nothing perceptible of that sort existed at the end of the 1970s, when four nuclear power plants were built. There are two Russian plants, each of a little more than 400 megawatts, and two Swedish ones, each of 600 megawatts.

Up to the present, they have only discussed the procurement of one plant in the 1,000-megawatt class.

Only the Russians and the French have been discussed as contractors. The nationalized Imatran Voima enterprise has investigated that alternative for about 7 billion marks in the terms of present-day monetary values. One argument favoring a purchase from the Soviet Union by Finland would be that this would produce a better balance of trade between the two nations. The Finns' problem is finding suitable import commodities on the Russian market.

The influential HELSINGIN SANOMAT mentioned on Thursday that Asea's prospects will be good when the project is taken under serious consideration.

That cannot take place until the government approves a new nuclear power bill that they are beginning to discuss this month.

Magnus von Bonsdorff, the director of Industrins Kraft AB, confirms the fact that they are interested in Swedish reactors. However, he brushes aside the question of the nuclear power bill. The only thing that is needed is a statement of its basic position by the government, he says.

However, he is reticent about time limits. Industrins Kraft AB is half privately owned and half owned by the state and the municipality. Among the interested parties are the nationalized enterprise Imatran Voima and private power companies and the wood-processing industry.

9266

CSO: 5100/2637

LONG TERM NUCLEAR WASTE DISPOSAL REPORTED ASSURED

Duesseldorf HANDELSBLATT in German 25 Aug 83 p 3

[Article: "Nuclear Energy/Waste and Intermediate Storage: Bonn Considers Long Term Nuclear Waste Disposal Assured"]

[Text] "The German disposal concept has passed the test." The disposal schedule decided upon by the Federal and provincial government heads on 28 September 1979 has allegedly "been followed in all points." Such is the final judgment of the Federal Republic in the "Disposal Report" issued by the Cabinet on Wednesday.

The decisive factor here is that the final storage of radioactive wastes anticipated near Gorleben and in the former ore mine near Salzgitter will be available at least for the late nineties, and a first reprocessing facility will be set up.

On the basis of the report, proof of waste removal from nuclear power plants, as it is required by the electricity industry, can according to the report also be safeguarded in the future. This means that there will be no interference with peaceful uses of nuclear energy from nuclear waste disposal. Allegedly, no bottlenecks need be feared even after the turn of the century.

The report includes for the first time a complete illustration of all radioactive materials accumulating in peaceful application of nuclear energy, their treatment, together with measures for regulated waste elimination. Accordingly, by 31 December 1982, a total of about 19,500 cubic meters end waste (waste conditioned for final storage) with low and medium radioactivity had been deposited. In addition, a total of about 12,400 cubic meters of non-conditioned raw wastes with low and average radioactivity was stored.

Intermediate waste storage proceeds at this moment on the territory of the nuclear power plants, in nuclear research centers, in industrial plants and in the provincial collection sites. In addition, intermediate outside stores for wastes with low or average radioactivity are in the planning or construction stages: Gorleben, with a capacity of about 35,000, and Mitterteich, with one of about 40,000 barrels. The nuclear research centers and provincial collection sites are planning and building more intermediate stores for a total of about 100,000 barrels.

The capacity for storage of spent fuel elements authorized at this time amounts to a total of 4,200 tons; in addition, about 6,440 tons have been requested. Added to the temporary storage in nuclear power plants must be the intermediate stores at Gorleben, where according to the report storage can be expected by 1984. The other capacities are distributed over other outside temporary stores (about 3,240 tons). They are distributed between Ahaus (starting in 1985), Stade (request documentation is being processed at this time) and the entry store of the planned reprocessing facility Wackersdorf, together with the Dragahn location.

Under identical framework conditions as adhered to when making an estimate of the amount of spent fuel elements (30,000 to 35,000 MW of electrical power from nuclear power plants by the year 2,000), the accumulated amounts of wastes with low or medium radioactivity were estimated up to the year 2,000. According to this, an accumulated end waste of 327,800 cubic meters should result with an installed nuclear power (electrical) of 30,200 MW. Should the installed nuclear power amount to 35,300 MW according to a different estimate, a final waste of 332,700 cubic meters should result by the year 2,000.

At present, eleven light water reactor power plants are in operation in the Federal Republic of Germany, each with over 300 MW. Partial construction authorization has been granted for ten additional nuclear power plants with light water reactors.

The Deutsche Gesellschaft fuer Wiederaufbereitung von Kernbrennstoffen mbH [German Association for Reprocessing of Nuclear Fuels] addressed in October 1982 a request to the Bavarian government, and in November 1982 to the Lower Saxonian provincial government for establishment and operation of a reprocessing facility with an expected average capacity of 350 tons per year each. The facilities are of the same design, except for the capacity of the entry stores. They also anticipate a possibility of setting up at the same location areas for fuel element production from separated uranium and plutonium for reuse in nuclear power plants.

Concerning the reprocessing problem, the report does not show any preference for one of the two locations Wackersdorf or Dragahn which are considered. The German Reprocessing Association, on the other hand, is planning the establishment of only one reprocessing facility. The provincial Bavarian and Lower Saxonian governments have agreed on a coordinated development of methods up to the granting of a first partial construction authorization.

For example, in Bavaria the space regulation process was concluded for the Wackersdorf site. A first partial construction authorization is anticipated by early 1985. Also the provincial government for Lower Saxonia is trying to obtain a decision concerning a first partial construction authorization by early 1985. The start of operation of a reprocessing facility can be expected for 1992 according to the report.

The operators of nuclear power plants in the Federal Republic of Germany have concluded contracts for storage and reprocessing of spent fuel elements with the foreign partners Compagnie Generale des Matieres Nucleaires (COGEMA), France, and British Nuclear Fuels Ltd. (BNFL), Great Britain. The amounts agreed upon to date represent a total of approximately 2,800 tons at COGEMA and about 760 tons for BNFL.

9243

CSO: 5300/2787

## BASQUE GROUPS PROTEST NUCLEAR DUMPING

Guipuzcoa EGIN in Spanish 20 Aug 83 p 5

[Text] Bilbao (EGIN)--The Antinuclear and Ecologists Committees of Euskadi [Basque Fatherland] have published a call to arms against the new attack on nature being prepared in the Atlantic Basin, with the threat of more nuclear dumping off the coasts of Galicia between and 6 and 11 September, with the wastes coming from Swiss and Belgian plants.

In sounding their general alarm, the committees say that "after the victory achieved by the temporary suspension of dumping by Great Britain, and with the demonstrations in Galicia and the rest of the nation, as well as in a good part of Europe, the new attempt by Switzerland and Belgium is doubtless a trial by fire to see whether or not this type of operation can be continued in the basin." They also add that "if both countries succeed with their proposals, no one could prevent other European states, the customary "clients" in the dumping business, from doing the same thing with their atomic garbage in the future.

To this effect they are requesting maximum solidarity with Galicia, as well as demonstrations: "The sea has no borders," says the call, "and what is dumped today in Galicia can be dumped tomorrow in Euskadi." Several anti-nuclear and ecologist groups have held meetings to coordinate a unified action in response to the imminent threat and have reached several decisions which can be implemented immediately.

### Will Go to Belgium

The first of these would be to carry out protests, on the days when dumping is announced, wherever it is possible. A second initiative will be to charter a bus for all these groups to go to Brussels (Belgium) and try to prevent the departure of the ship carrying the radioactive drums. Spanish stevedores' and seamen's unions will also be asked to show their solidarity by sending to their Belgian counterparts telegrams asking them to oppose the loading and departure of the ship.

A fourth and last proposal is to charter a boat to Brussels and later, if the situation warrants, to the Atlantic Basin itself, to join in demonstrations against the dumping which are being planned by the Greenpeace ecologist organization.

At the same time, the well-known scarcity of resource materials for Spanish ecologist groups participating in the struggle, such as AEPDEN of Madrid, CANC of Catalonia, ADEGA of Galicia and the Antinuclear and Ecologists Committees of Euskadi, as well as other groups from the Canaries and Portugal, has forced them to announce the opening of a bank account to which any citizen may send a contribution for their support. The account has been opened at the Popular Labor Savings Bank under the number 083/0/01909/0. In addition, collections will be taken up at fairs now being held or about to be held in the villages and capitals of Euskadi. Specifically, in view of the Aste Nagusia of Bilbao, the Ecologists and Antinuclear Committees are asking the help of all the "konparsas" who are inspired by the great festival of the capital of Vizcaya.

#### Euskadi Group Denounces Dumping

Members of the Galician Nationalist Bloc in Euskadi have published a communique "energetically" condemning the new series of radioactive dumpings which will be carried out on 5 and 6 September off the Galician coast by Belgium, Switzerland and probably Great Britain.

"This action," the communique says, "represents a colonialist attack against the Galician national sovereignty and the inalienable right of the oppressed Galician people to dispose freely of their own resources."

The note also denounces the "belligerent attitude of the states doing the dumping and the inactive, permissive and neglectful policy of the Galician Junta as well as of the Spanish Government."

The members of the BNG [Galician Nationalist Bloc] in Euskadi demand in addition an end to the dumping and "a total reorganization of the nuclear policy, since the real reason for the problem is inherent in the present policy."

Finally, the Galicians request the solidarity of the "struggling Basque people, who have been beset by a similar problem." To this effect they show their solidarity with the actions to be carried out by the Euskadi Antinuclear Committees and those institutions "which are struggling to achieve national sovereignty."

8735

CSO: 5100/2634

END